AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

JULY 1959

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Precision Metal Molding

PMM

INCLUDING DIE CASTINGS' MAGAZINE

DIE CASTINGS

EXTRUSIONS

INVESTMENT CASTINGS

PERMANENT MOLD CASTINGS

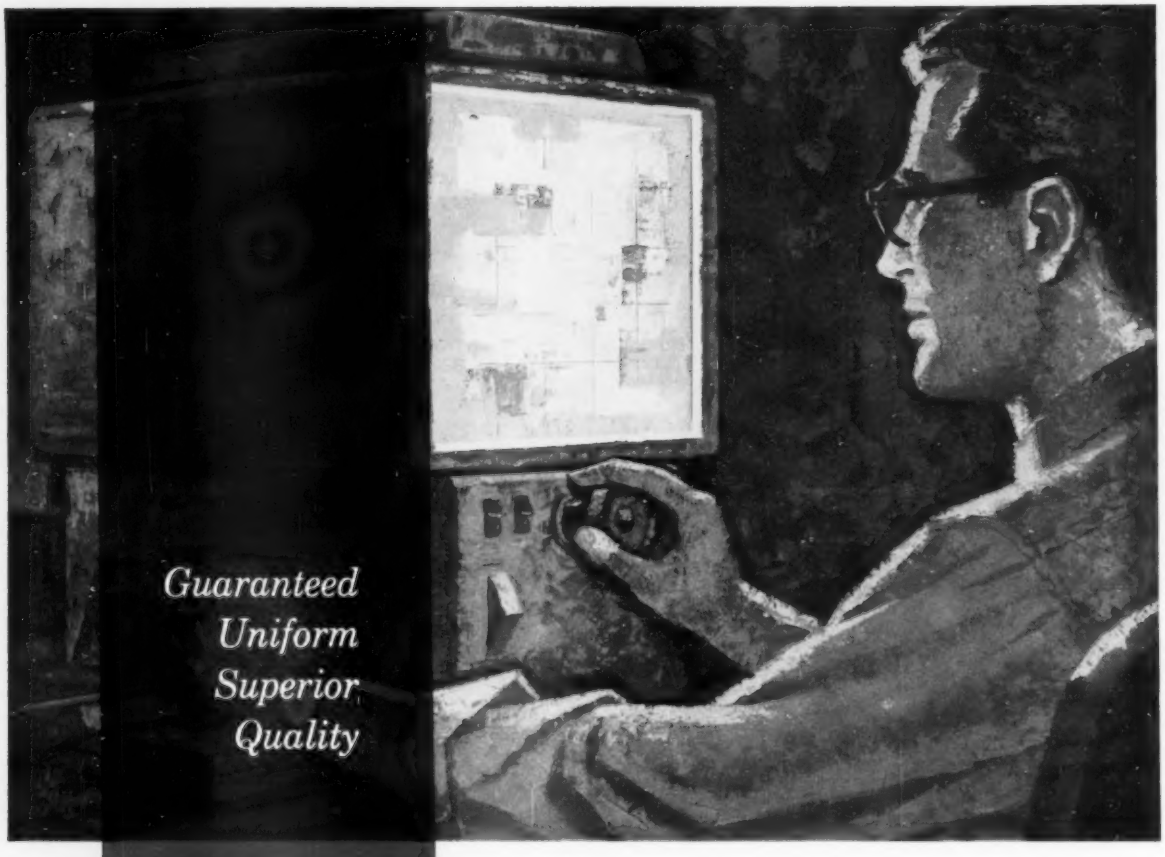
PLASTER MOLD CASTINGS

SINTERINGS

SHELL MOLD CASTINGS

"Neither atmospheric corrosion nor winds of near tornado velocity will damage these lightweight die cast fixtures."

— see Page 3



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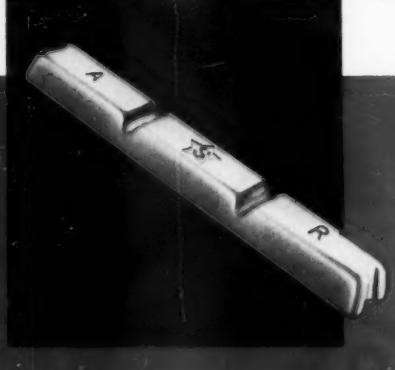

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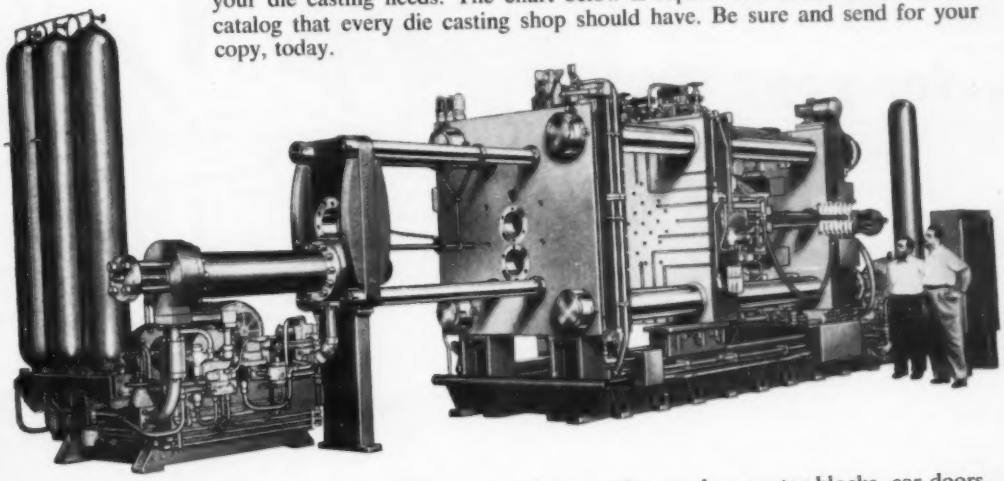
FILE NOTE:

There Are 17 Cast-Masters For Every Die Casting Need

Whether your requirements call for precision parts of a few ounces in weight or a massive casting of 85 pounds, there's a Cast-Master to fit the job. It's a line that sparkles with a range of models, each with outstanding features for your die casting needs. The chart below is reproduced from the brand new catalog that every die casting shop should have. Be sure and send for your copy, today.



MODEL 60A Cast-Master for exceptionally large, intricate castings such as motor blocks, car doors, large housings, etc. This huge 2000 ton Cast-Master has proved its usefulness in the field.

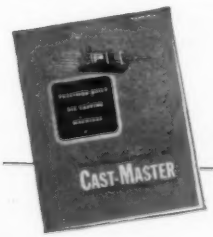
THE CAST-MASTER LINE FOR PRECISION DIE CASTINGS

PLUNGER GOOSENECK TYPE: *Zinc, Lead and Tin*

MODEL	7Z	9Z	10Z	15Z	20Z	30Z	40Z	50Z
Locking Pressure (Tons)	100	200	300	400	500	600	800	1000
Tie Bar Centers (In.) Ver.	16	19½	23	26	30½	32½	37	46
Hor.	16	19½	23	26	28½	32½	40	46
Tie Bar Diameter (In.)	2½	3½	4	5	5½	6	7	8
Space Between Tie Bars (In.)	13½x 13½	16x 16	19x 19	21x 21	23 Hor. 25 Ver.	26½x 26½	33 Hor. 30 Ver.	38x38
Die Mounting Plates (In.)	3½x 21½x 21½	4½x 26x 26	5x 32x 32	6x 36x 36	7x 38x 40	8x 48x 44	9x 52x 54	Stat. 12x60x60 Mov. 10x60x60
Die Thickness (In.) Min.	4	6	8	8	8	12	20	20
Max.	19	24	24	28	36	38	38	44
Die Stroke (In.) (Adjustable) Min.	4	6	6	8	9	12	18	18
Max.	8	10	10	12	15	18	24	24
Injection Cylinder Dia. (In.)	2½	3⅛	3⅝	4⅛	4⅛	4⅝	4⅝	6⅛
Injection Cylinder Stroke (In.)	6½	7¼	7¼	7¼	7¼	10	10	14
Metal Pot Capacity (Lbs.)	800	1000	1000	1000	1000	2000	2000	3000

COLD CHAMBER TYPE: *Aluminum, Brass and Magnesium*

7A	9A	10A	15A	20A	30A	40A	50A	60A
100	200	300	400	500	600	800	1000	2000
16	19½	23	26	30½	32½	37	46	62
16	19½	23	26	28½	32½	40	46	62
2½	3½	4	5	5½	6	7	8	11
13½x 13½	16x 16	19x 19	21x 21	23 Hor. 25 Ver.	26½x 26½	33 Hor. 30 Ver.	38x38	51x 51
3½x 21½x 21½	4½x 26x 26	5x 32x 32	6x 36x 36	7x 38x 40	8x 48x 44	9x 52x 54	Stat. 12x60x60 Mov. 10x60x60	18x 80x 80
4	6	8	8	8	12	20	20	20
19	24	24	28	36	38	38	44	54
4	6	6	8	9	12	18	18	22
8	10	10	12	15	18	24	24	36
3	4⅛	4⅛	4⅝	4⅝	5⅛	5⅝	6⅛	8¼
11	14½	12 to 16 Adj.	12 to 17½ Adj.	14 to 19½ Adj.	16 to 22 Adj.	18 to 24 Adj.	22 to 28 Adj.	30 Min. 44 Max.



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IN THIS ISSUE

July, 1959: Volume 17 Number 7

COVER

WESTINGHOUSE ELECTRIC CORP.'S Robert W. Miller, manufacturing engineer (left), Paul R. Ziman, general foreman, foundry (center), and J. T. Drylie, superintendent, foundry (right), discuss advantages of a die cast housing used on street lighting fixtures. Among these merits are better appearance, lighter weight, and lower cost. Because of the size of this casting, and its thin walls, stiffening ribs and other features were designed into it. For the complete story on how and why Westinghouse uses die castings, see Page 38.

FEATURE ARTICLES

27 NEW HIGH-STRENGTH ALUMINUM ALLOY
Here's a new high-purity silicon-magnesium-titanium alloy of aluminum (X357) developed by Kaiser Aluminum & Chemical Co.

28 COMPACTING PRESSES AND TOOLING SYSTEMS
Your job of designing powder metallurgy parts can be made a lot easier if you're familiar with the different types of presses. This report from Kux Machine Co. tells what they are, how they work.

32 MOLYBDENUM DIE CASTING DIES
A PMM Report to Industry on the progress being made in research on the use of molybdenum for die casting dies conducted separately by General Electric Co. and the American Die Casting Institute.

34 MECHANICAL PROPERTIES OF INVESTMENT CAST 410
Precision Metalsmiths, Inc., conducted tests to determine the effect of varying tempering temperatures on the mechanical properties of investment cast 410 stainless steel. Here are the results.

37 HIGH-TEMP, HIGH-STRENGTH DIE CASTING ALLOY
Another PMM Report to Industry, this one covers HM11XA, a new magnesium-thorium alloy developed by The Dow Chemical Co. This new alloy can be die cast in conventional machines and dies.

38 HOW WESTINGHOUSE USES DIE CASTINGS
Westinghouse Electric Corp. uses die cast housings and lens rings for some lines of street lighting fixtures. What these castings look like, what they're expected to do, and how they're made are discussed.

40 INVESTMENT CASTING INSTITUTE STANDARDS
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43 DESIGN TIPS
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44 SINTERED FILTER GIVES SAFE, EFFECTIVE VENTING
This filter, made by powder metallurgical methods, was the answer to the safe and effective venting of gasoline storage tanks.

59 PROPERTIES OF EXTRUDED ALLOYS
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60 IMPACT-EXTRUDED HIGH PRESSURE BODY
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50 FINISHING ABSTRACTS
Here's the first in a series of abstracts from *Metal Finishing Abstracts* published by Robert Draper, Ltd., of England.

51 VACUUM PLATING ZINC DIE CASTINGS
By changing from electroplating to vacuum metallizing, Nichols Industries, Inc., was able to aluminum-coat zinc die castings quicker, less expensively, and with a brighter finish.

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BROADER HORIZONS

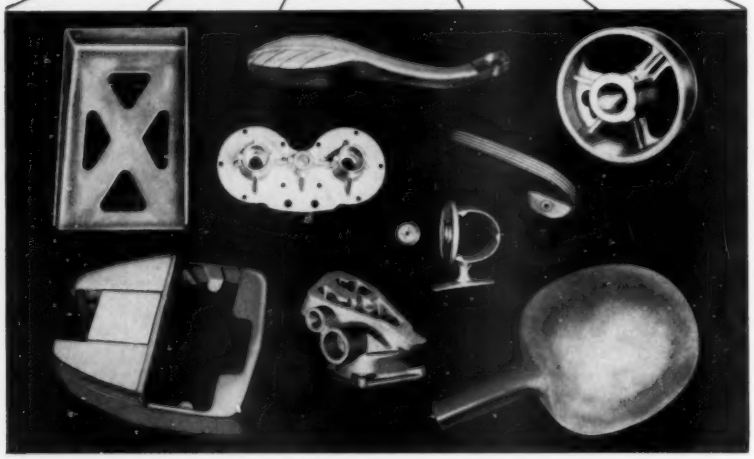
For Your Products with

ALUMINUM • MAGNESIUM • ZINC

DIE CASTINGS

by

LITEMETAL



The die casting process, which effects great savings in time and materials and virtually eliminates costly labor otherwise required for machining and finishing, can be efficiently used in the production of parts for practically unlimited fields of manufacture. LITEMETAL DICAST, INC., one of the few active producers of aluminum, magnesium and zinc die castings, is an organization of specialists — men thoroughly experienced in the casting and machining of these alloys.

Typifying the "broad horizons" for application of the die cast process are the parts and products by LITEMETAL shown in the photograph above:

OFFICE EQUIPMENT	Business Machine Housing
ELECTRICAL	Power Switch Handle
RECREATION	Table Tennis Paddle
MECHANICAL TOY	Racing Car Brake Pedal
MUSIC	Juke Box Tone Arm
AUTOMOBILE	Automotive Oil Pump
HOUSING	Garage Door Cable Drum
TRUCK	Air Horn Base
FISHING EQUIPMENT	Spinning Reel Gear and Frame

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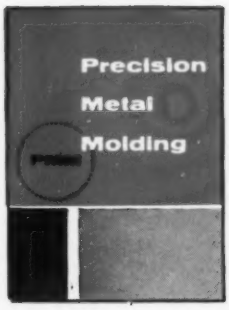

DISTILLED WRITING

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Editorial and executive offices: 812 Huron Rd., Cleveland 15, O.

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SUBSCRIPTIONS in U.S. and possessions: $7, 1 year; $12, 2 years. Canada: $8 per year. Foreign: $10 per year, payable in advance in U.S. funds. U.K.: £3.5.0 per year payable in Sterling to London office. Single copies, when available: 1 to 10 — 75¢ each; 11 to 25 60¢ each; over 25 45¢ each.

AFFILIATED PUBLICATIONS: Applied Hydraulics & Pneumatics, The Refrigeration & Air Conditioning Business, Material Handling Engineering (formerly Flow), Material Handling Illustrated, Modern Office Procedures, Occupational Hazards, Power Transmission Design, Welding Design & Fabrication, Welding Illustrated. Member BPA.

Accepted as a controlled circulation publication at St. Joseph, Michigan. Not responsible for unsolicited editorial material. Please return Forms 3579 to 812 Huron Rd., Cleveland 15, Ohio.

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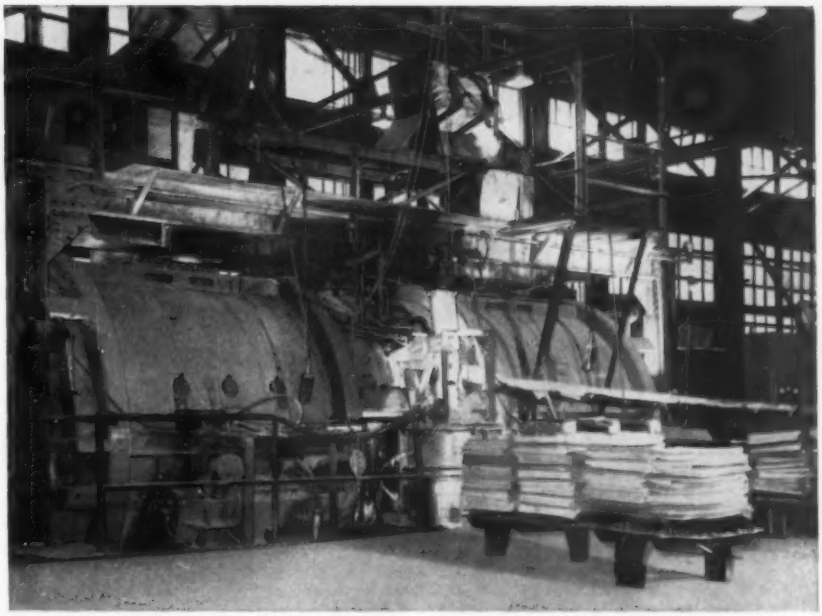
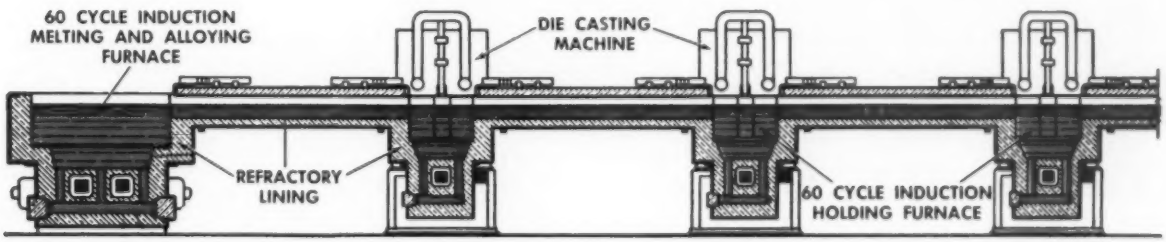


BUNKER HILL SPECIAL HIGH GRADE ZINC SLAB PRODUCED IN THE AJAX FURNACE

High in the mountains of Idaho, the AJAX-TAMA-WYATT 800 kw induction furnace melts 235 tons of electrolytic zinc cathodes day after day. THE BUNKER HILL COMPANY, originators of Special High Grade Zinc, take pride in the purity (99.99+% Zn) of the slab poured from this 60 CYCLE INDUCTION MELTING unit. Such pure metal insures the soundness of the many zinc die castings used in our cars and appliances.

To maintain this purity when remelting the slab for die casting, hundreds of AJAX-TAMA-WYATT furnaces are used today in our busy industrial regions. The diagram below shows a modern zinc die casting line for automotive parts, using a central 60 CYCLE INDUCTION MELTING and alloying furnace, and holding furnaces at each machine. Connecting electric molten metal runways eliminate all metal transfer labor. Unexcelled metal quality, low metal losses, reliability and economy of operation are assured by using 60 CYCLE INDUCTION MELTING throughout.


60 CYCLE INDUCTION MELTING AND ALLOYING FURNACE
DIE CASTING MACHINE
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MUELLER BRASS SAVES $15,000 A YEAR ON FORGING LUBRICATION

Efficiencies realized by just one company — with the help of Acheson Dispersions — have already added up to this substantial savings. Uniform coverage, easy sprayability, and lasting lubrication effectiveness are providing this leading forgings producer: longer die life, increased production, fewer rejects, and improved forgings. This lubricating success story is being repeated throughout the metal working industry. Possibly *you* could profit from the use of an Acheson Dispersion.

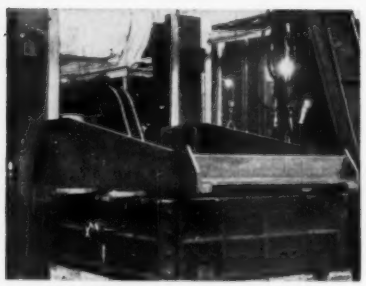
'Prodag' application on forging presses at Mueller Brass Company has saved between $15,000 and $17,000 annually for the past fifteen years. These impressive savings earned by this Port Huron, Michigan company — the world's largest producer of brass and bronze forgings — have been realized in many areas.

Previously, crank forging pressmen at Mueller swabbed the dies between each press stroke. Mueller designed their own spray apparatus, both manual and automatic, to lubricate lower and upper dies simultaneously. Time studies have shown that spraying has effected a five percent-per-pound economy over the swab method.

Spray application of 'Prodag' at Mueller Brass Company has resulted in impressive production savings.

Even more importantly, by using Acheson's 'Prodag' — a dispersion of graphite and water — diluted 1:35, Mueller has gained longer die life, reduced the percentage of scrap loss, and has obtained a better finish on their forgings. According to Mr. O. M. Hanton, Chief Forging Engineer for Mueller, "with 'Prodag' we get the right amount of lubricant on the die. Swabbing resulted in too much lubrication at one place or another in the die cavity, resulting in either a ruptured die or a defective part. Previously, every forging produced had to go to the grinding department. And grinding is one of the most expensive operations in a forge shop."

In producing deep-cavity forgings, or products which demand much smaller tolerances, Mueller uses 'dag' No. 3 — another of Acheson's graphite-water base dispersions. If you have a forging lubrication problem it will pay you to call in your Acheson Service Engineer or write for Bulletin No. 426.



'dag' 35, brush-applied to the slides of this rollover machine, increases machine life for this midwest foundry.

An expensive foundry problem was solved for the D. J. Murray Manufacturing Company, Wausau, Wisconsin, with the use of Acheson's 'dag' 35 — colloidal graphite in an alkyd resin solution. Slides on the huge rollover machine installed in their foundry division, previously lubricated by first a dry graphite and then rosin, were becoming deeply scored as a result of its 90-cycle-a-day operation in the handling of bench and floor molds.

The scoring and machine vibration was so severe that according to Maintenance Foreman, Ben Sayles, "we could see that the life of the machine was going to be very short if we continued this method of lubrication." Coating the slides daily with 'dag' 35, improved machine operation immediately. The scoring all but disappeared. After two years of application with this Acheson dispersion, no repairs have been necessary and none are foreseen. Since the entire production of their grey iron sand slinger line — some 60 tons of material in 8 hours — goes through this machine, the downtime avoided represents an important savings to the company.

For additional information, write for Acheson Bulletin No. 425. Address Dept. PMM-79.

ACHESON *Colloids Company*

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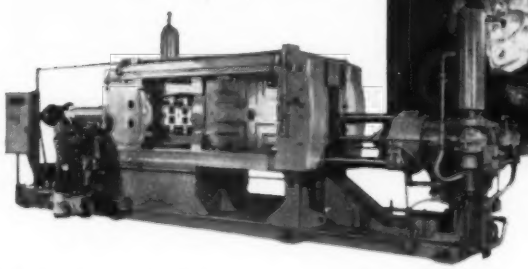
WE TRIED... AND FOUND OUT!

says: MILTON R. HOEPPNER
Administrative Assistant
McCulloch Corporation
Los Angeles, California



"Orders were building up for our largest outboard motor die castings, so we decided to step up production by farming out the dies for the aluminum castings. It was a good idea except for one thing—no one else in this area owned an 800 Ton Lester—the kind we were using to cast the 30 lb. block for the motor.

"Without the Lester, they just couldn't give us comparable quality—the kind we demand for our products. As a direct result, *we* ordered more Lesters. In fact, two of them are 1000 Ton machines, with bigger platens and more speed and pressure, so we'll be able to make even better parts ourselves. By July, 1959, we'll have nine Lesters, ranging from 600 to 1000 ton clamp, running at McCulloch Motors."

The seeming limits of fine die casting are being pushed back every day by Lesters. If you are planning demanding die castings, TEST A LESTER! You'll be pleased and profited by the results.

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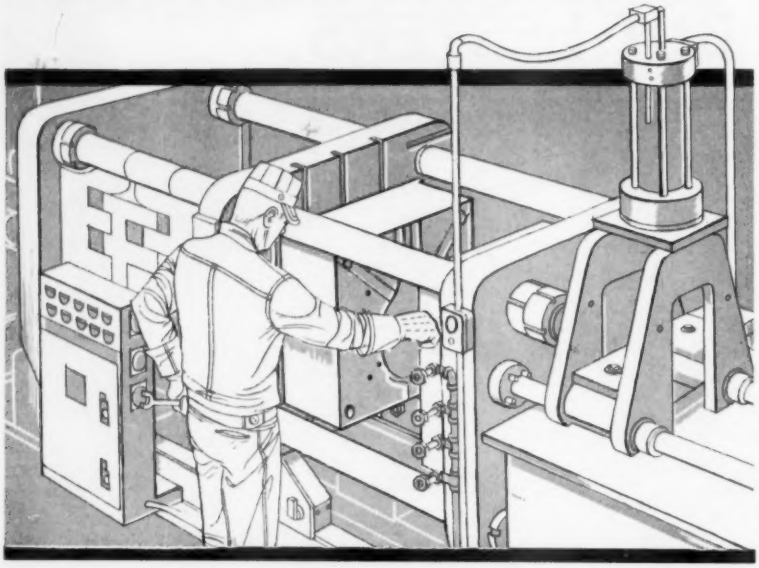

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PMM LETTERS

the readers' forum

DIDN'T GET IT

We do not seem to have received any copies of PRECISION METAL MOLDING for quite a while. Has our name been taken off the mailing list? We read all copies when they come in, and would appreciate receiving all of the issues for 1959, if possible. — H. H.

We receive doezens of letters like this one every month. PMM is an audited book. Every year we have to prove to the BPA auditors that the names, addresses, company affilations, and job titles of all the names on our circulation list are authentic. That's why you get a card asking you to check the address data, correct it if necessary, and mail it back to us. If you fail to do this our auditors throw your name out. I know that checking and returning a verification card seems like a job that can be put off for a few minutes. Generally that few minutes runs into permanently. If you want to keep on getting PMM be sure to fill in the verification card as soon as you get it and mail it back to us at once. — Ed.

BIBLIOGRAPHY

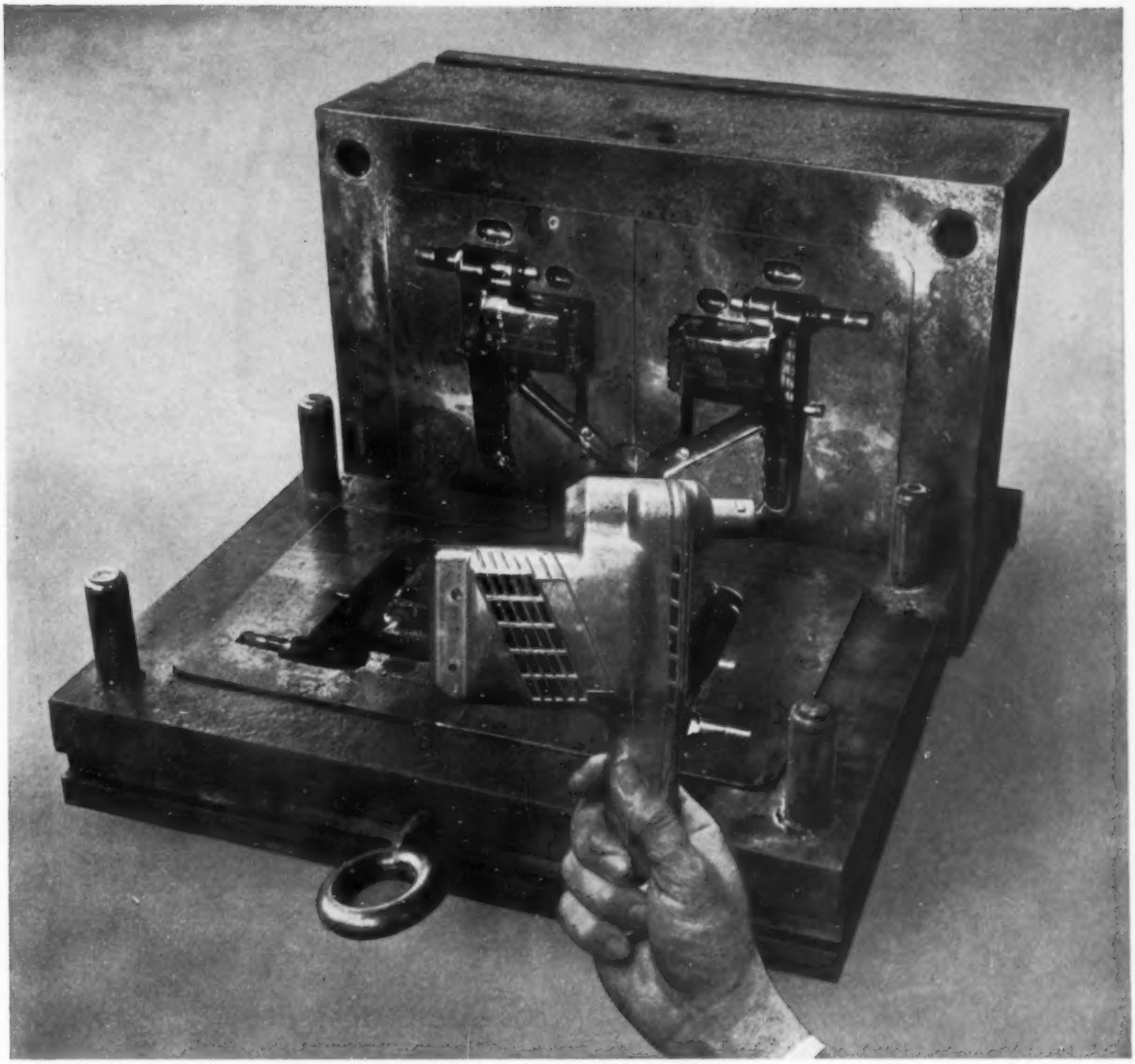
Could you please send us four or five copies of the bibliography on powder metallurgy announced in the hook-on attachment to the May issue. While we have seen, and probably clipped, most of these articles, your list will be of value. M.H.R. — market development div.

The bibliography refered to is of all articles on powder metallurgy which have been published in PMM from Sept., 1951 through Dec. 1958. Copies have, of course, been sent. — Ed.

PLASTER MOLD CASTING

Please give us the name of a firm where we may buy plaster mold equipment, flasks, etc. — J. I. W., pres.

Because the industry is so small, most of the plaster mold casters build their own equipment or have it built to their own specifications However, if any of our readers know of companies who can furnish the kind of equipment this reader wants we'll be glad to forward their names. — Ed.



Team up with Cromo-High V for economical die casting

Nearly any die-casting job can be handled economically with Cromo-High V —Bethlehem's 5 pct chrome-moly tool steel with 1 pct vanadium.

Cromo-High V is engineered for die casting work. It's extra tough, and is resistant to wash and erosion. Made by a controlled melting procedure, it has good center density and grain refinement. It's also uniformly annealed for easy machining, and is free from porosity.

Cromo-High V is ultrasonic-tested to make sure that every bar has the same high quality. You can count on it to respond uniformly to heat-treatment. Even in massive sections it hardens up to Rockwell C 45-47.

Your Bethlehem tool steel distributor carries a complete range of Cromo-High V in stock, and is at your service. Give him a call today.

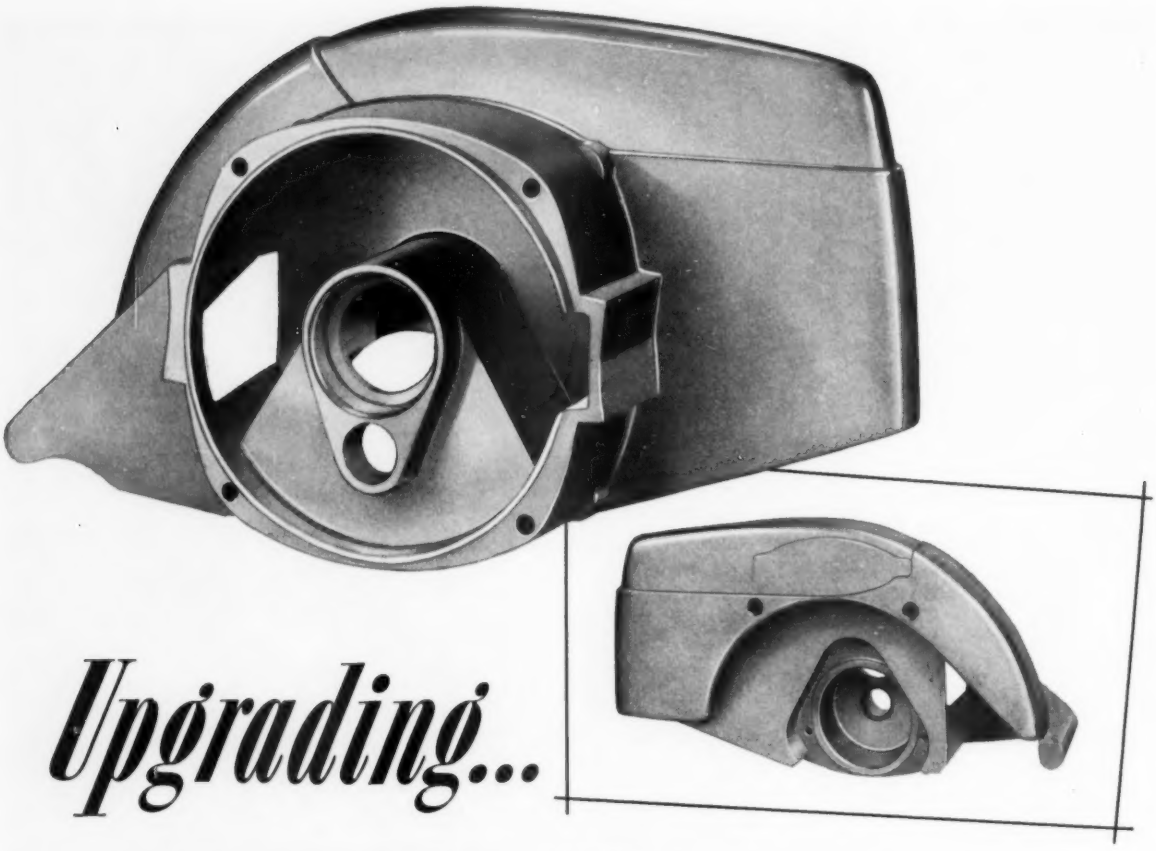
BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

For more information circle No. 13 on the Reader Service Card



Upgrading...

with MADISON-KIPP zinc and aluminum die castings

Die casting as a process, has many inherent advantages in providing lightness, strength and stability in parts that can be cast to dimensions requiring a minimum of machining. These advantages have greatly assisted in upgrading many mass-produced products from automobiles to toys.

To get maximum process utilization, the seasoned and skilled mechanics at Madison-Kipp have proved very helpful to highly placed engineers and designers for over a quarter of a century.

Please clip this ad as a reminder to contact us when you have die casting requirements.

kipp

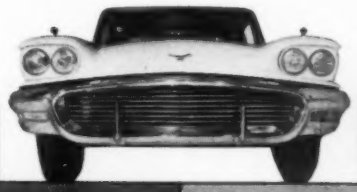
MADISON-KIPP CORPORATION
213 WAUBESA STREET • MADISON 10, WIS., U.S.A.

• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information circle No. 32 on the Reader Service Card

.....Today the proudest cars on the road glisten with Olin Aluminum

The exciting Ford Thunderbird is an example. Quality Olin Aluminum is going into the manufacture of most of the fine new cars. Bright, light aluminum resists corrosion, won't rust. No other metal gives car owners such lasting satisfaction. Olin Aluminum, in its first year as a major producer, is already a basic source of supply for the great names in the automotive industry.



OLIN ALUMINUM

OLIN MATHIESON • METALS DIVISION • 400 PARK AVE., N. Y.

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when it's for precision die-casting...

specify TADANAC zinc

Zinc offers more desirable mechanical qualities and casting characteristics at a lower cost than any other metal. For the very best in die-casting zincs, specify TADANAC BRAND — or alloys made from it.

For information and assistance regarding zinc die-casting, contact our Technical Service Staff. Your inquiries will be given immediate attention.

With TADANAC BRAND Zinc you get electrolytically refined zinc of consistent high quality, low in impurities and always in good supply with prompt delivery assured.

THE CONSOLIDATED MINING AND SMELTING COMPANY OF CANADA LIMITED

COMINCO

Metal Sales Division: 215 St. James Street W., Montreal 1, Quebec, Canada

Sold in United States by: AMERICAN METAL CLIMAX, INC., New York, Chicago, Detroit, Los Angeles

TADANAC ZINC SHAPES THE THINGS TO COME

9101

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after 30 years of serving the die casting industry in finishing we NOW offer you a complete die casting service

SEND FOR FREE BOOKLET

Take a tour of our modern plant by means of this well-illustrated booklet that shows our facilities for making and plating your die castings.

THE DISALLE PLATING & DIE CASTING CO, INC.
2851 SOUTH AVENUE • TOLEDO 9, OHIO

I am interested in learning more about your ability to produce and finish die castings for me. Please send me your photographic booklet showing your complete facilities without obligation.

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Title _____

Company _____

Address _____

City _____ Zone ____ State _____

For more information circle No. 17 on the Reader Service Card

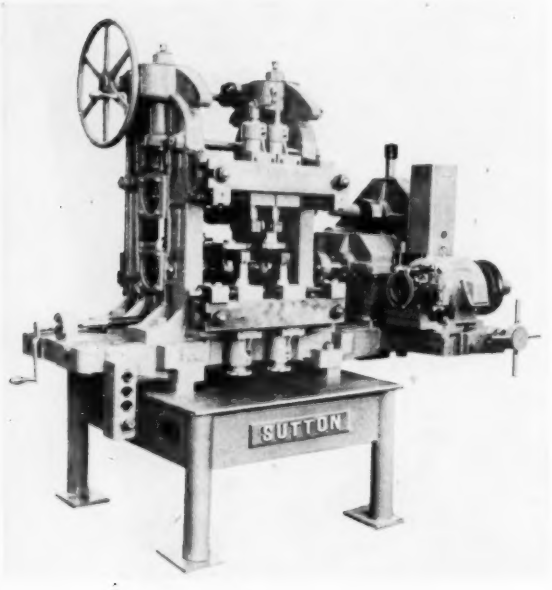
NEW PRODUCTS AND DEVELOPMENTS

Want complete details on these announcements? Use the Reader Service Cards. You'll find them facing page 68 of this issue

HIGH-SPEED HYDRAULIC PRESS

The "FD" series of high-speed hydraulic presses, developed by HANNIFIN CO., are described as ideal for forming, trimming and force-fit assembly operations. The presses which are available in both bench and floor models, feature dual hand and adjustable down-stroke controls, electric push button control with or without pressure reversal. Tonnage on the presses is adjustable from 10% of capacity to full, rated capacity. All models can be equipped with hydraulically operated index tables for high production, long run jobs.

Circle No. 239 on Reader Service Card



CONTOUR CORRECTING MACHINE

The Sutton Contour Correcting Machine corrects cross-sectional distortions of aluminum extrusions to extremely close tolerances. Developed by the SUTTON ENGINEERING CO., the machine can handle flat sections up to about 14" wide. It also can handle multiple corrections of shapes circumscribed by a 9" circle in one pass.

The correcting mechanism consists of two main-drive spindles with rolls. These may be used for correcting as well as traction. The mechanism also has up to eight correcting idler rolls, which may be positioned in many different ways on as many as twelve tool holder positions.

After initial set-up, tool holders may be adjusted externally, both vertically and horizontally, to apply increased or decreased pressure. This cuts set-up and change-over time.

The correctors are available in various sizes and capacities. Multiple stands may be used as required.

Circle No. 240 on Reader Service Card

VIBRATORY FINISHING MACHINE

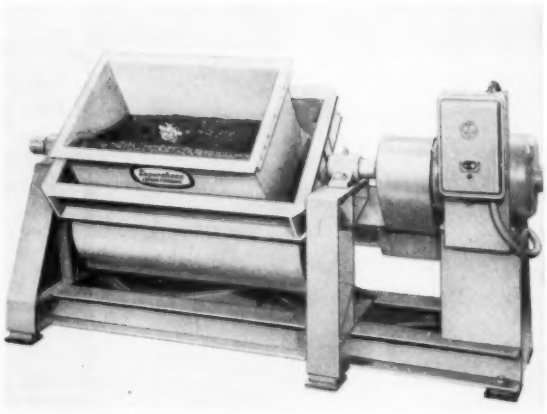
Vibrasheen is a precision finishing machine for deburring, descaling, cleaning, burnishing and surface refinement of metal parts. Developed by ALMCO, QUEEN PRODUCTS DIV., KING-SEELEY CORP., the machine vibrates the entire 5 cubic foot load of parts and media. This utilizes a scrubbing action to remove burrs and to finish parts in exceptionally fast time.

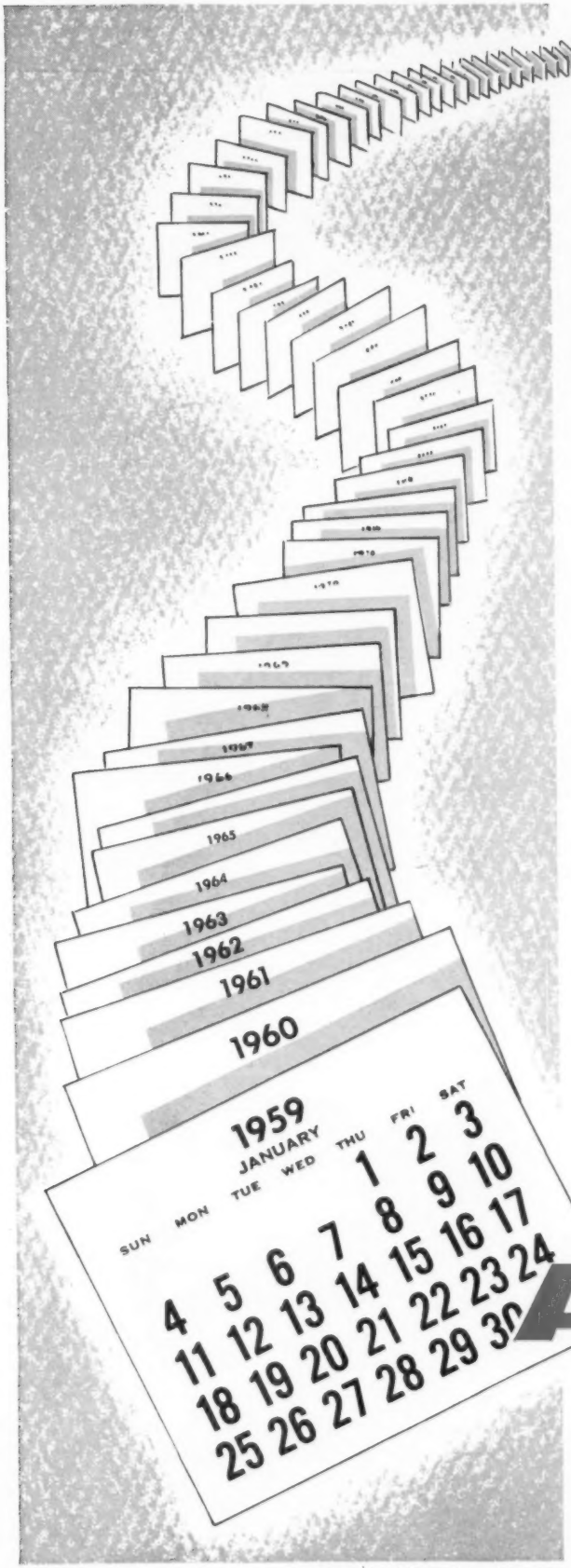
Vibrating ampliture is adjustable to 7 settings from 1/64" to ¼" at a frequency of 1800 vpm. Variable frequency can also be obtained.

The container is lined with ½" bonded neoprene and measures 31" long, 17" wide and 19½" deep. The container pivots 120° for dumping the entire load into hoist pans.

Circle No. 241 on Reader Service Card

continued on page 61





LOOKING 60 YEARS AHEAD

American Zinc takes a look ahead for American Industry... and a look back

What about America's future zinc supply? Recent development work at our Tennessee properties confirms that we have at least another 60 years' supply of zinc concentrates underground. And this estimate is conservative, being based on a projected stepped-up rate of production.

This 60-year supply is, in effect, 60 years of assurance for the large part of American Industry which has learned to depend on American Zinc for zinc, *the dependable metal.*

American Zinc this year celebrates its 60th anniversary. A look back shows 60 years of service to American Industry . . . and a look ahead shows at least 60 years of America's industrial future stored away in American Zinc mines, ready to take a vital role in our nation's future growth.

American Zinc sales company

Distributors for AMERICAN ZINC, LEAD & SMELTING COMPANY
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For more information circle No. 7 on the Reader Service Card

MT. VERNON DIE CASTINGS help STANLEY develop stronger, lighter, tougher heavy-duty builders' saws

CASE HISTORIES FROM MT. VERNON FILES

Stanley packs more power into its new line of low-cost, heavy-duty saws . . . and saves important weight doing it! They have been designed for greater utility, with such features as: Ball bearing guard — fingertip depth-or-bevel setting, uncluttered front — window brush-holder for simpler servicing, extra handling comfort, positive control, etc. Yet, with all these improvements, Stanley is still able to sell these better saws for less!

A big reason for this lower cost is Mt. Vernon's coordinated four-fold die casting service: designing, die-making, casting and machining. Mt. Vernon worked closely with Stanley* to create light, thin-walled aluminum castings with strength to spare. All parts are produced with excellent surface finish to facilitate barrel burnishing. Many fit together without machining thereby contributing to lower manufacturing and assembly costs.

Stanley is typical of the leading manufacturers in the power tool industry who know and rely on Mt. Vernon's experience and facilities for die cast zinc and aluminum parts. As the largest independent die casting company — with over 200,000 square feet under one roof — our services and equipment are ready to help solve your design and production problems. We'll be glad to discuss the advantages of die castings with you at any time. Just call your nearest Mt. Vernon sales representative.

*Stanley Electric Tools, New Britain, Conn.

MT. VERNON
DIE CASTING CORP.
STAMFORD, CONNECTICUT

DIE CASTING RESEARCH FOUNDATION PARTICIPANT

SALES REPRESENTATIVES

BROOKLYN, N. Y.: Mr. Robert V. Moore, 2317 Plumb 2nd St.
CLEVELAND, OHIO: Mr. Grant Eller, 6 East 194th St.
GUILDERLAND, N. Y.: Mr. David H. King, 75 Willow St.
LUTHERVILLE, MD.: Mr. C. McIntosh Gordon, Box 55, R.R. No. 1
PITTSBURGH, PA.: Mr. Andrew W. Anderson, 300 Pasadena Drive So.
QUINCY, MASS.: Mr. Edmund W. Libby, 91 Merrymount Rd.
ROCHESTER, N. Y.: Mr. William Sauers, 101 Briarcliff Rd.
SKANEATELES, N. Y.: Mr. Jerome J. Theobald, 9 E. Genesee St.
STAMFORD, CONN.: Mr. Anker Anderson, Cascade Road
VALLEY FORGE, PA.: Mr. G. T. McMaster, P.O. Box 115

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Your source for quality controlled aluminum die-casting metals. Federated aluminum ingot production is under rigid controls developed by Asarco's Central Research Laboratory. Federated Sales Engineers back up every shipment with on-the-spot assistance based on long detailed experience. For a complete choice of both aluminum and zinc die-casting alloys, call any one of the 11 plants and 23 sales offices of Federated Metals Division, 120 Broadway, New York 5. In Canada: Federated Metals Canada, Ltd., Toronto and Montreal.

FEDERATED METALS DIVISION OF

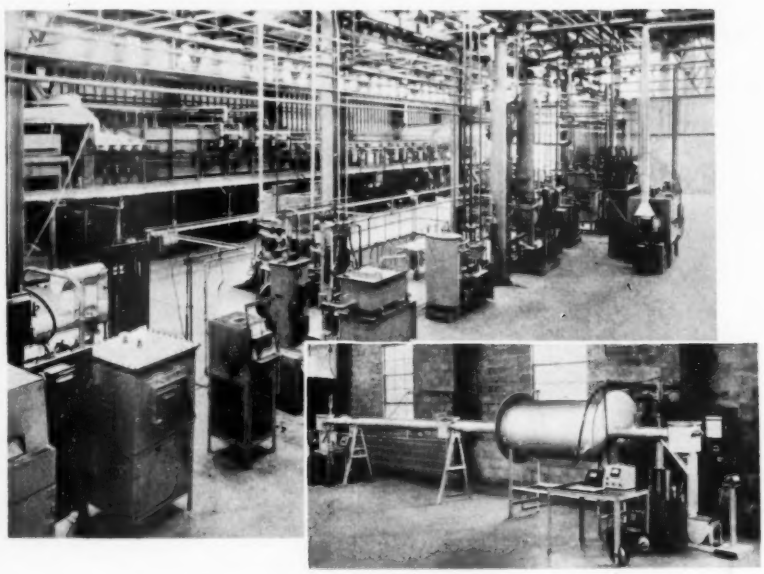
ASARCO

AMERICAN SMELTING AND REFINING COMPANY

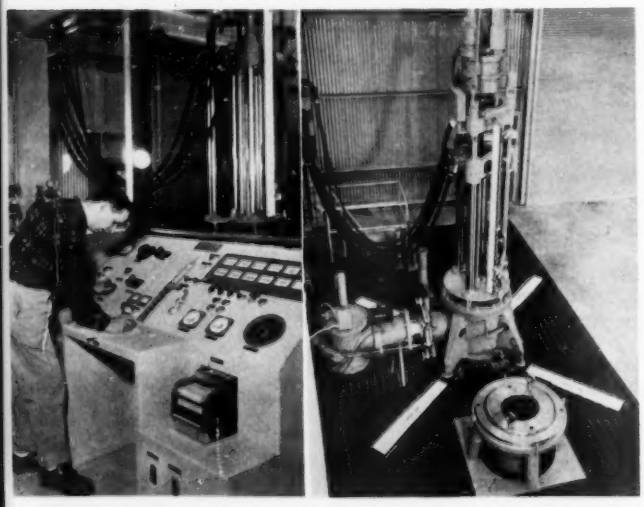
CASTING ABOUT

technical news of applications & processes involving precision metal moldings

WITHOUT HEAT-TREATING furnaces, modern industry would grind to a standstill. Both fuel and electrically fired heat-treating furnaces for ferrous and non-ferrous metals transform a non-useable, or at best an inferior product into the high applicability materials we have today. Take, for example, the continuous strip annealing furnaces shown. The larger one is a controlled atmosphere unit over 100 ft. long. With a variety of heating and cooling zones strip can be processed to almost any specifications. Where a customer has a strip heat-treating problem, it can be solved in this furnace and a production unit designed to give the precise heating and cooling cycle needed for the best results. Or in the case of the exotic metals, for example, where gas absorption could ruin the properties of the strip, then continuous vacuum annealing may be the answer. The furnace shown (inset) can operate at temperatures up to 2100°F and at pressures as low as 1 micron. Mercury seals prevent air leakage and all gas contamination is avoided.



VACUUM MELTED STEEL is beginning to be understood and valued by industry. To supply the growing demand for improved tool steels, high temperature—high strength alloys, and some of the so-called exotic metals, Latrobe Steel Co. has installed a consumable-electrode, vacuum arc melting furnace. The furnace, designed and installed by the Lectromelt Div., McGraw Edison Co. has a maximum ingot capacity of 8500 pounds and a production rate of 3000 tons per year. Using mechanical pumps only, the blank off pressure obtainable is under 5 microns and normal operation, when melting, is from 20 to 30 microns. The mechanical pumps have a capacity of 4500 cu. ft. per minute.



The consumable electrode is a specially prepared ingot of the metal to be melted. The mold, a water cooled copper cylinder which also acts as the second electrode when the arc is first struck.

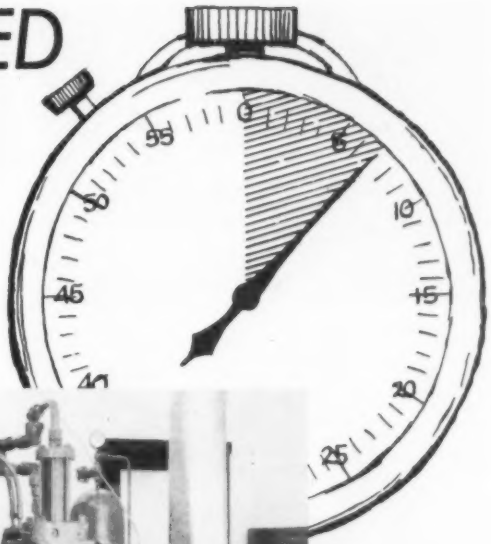
As soon as an arc is formed, a pool of molten metal forms on the bottom of the crucible and is rapidly chilled by the water cooling. In this manner a fine-grained ingot is formed which is entirely free of dendritic structure. Any impurities in the metal electrode float on the surface of the pool of liquid metal and are collected on top of the ingot. There are essentially no impurities in the ingot and little, if any, segregation.

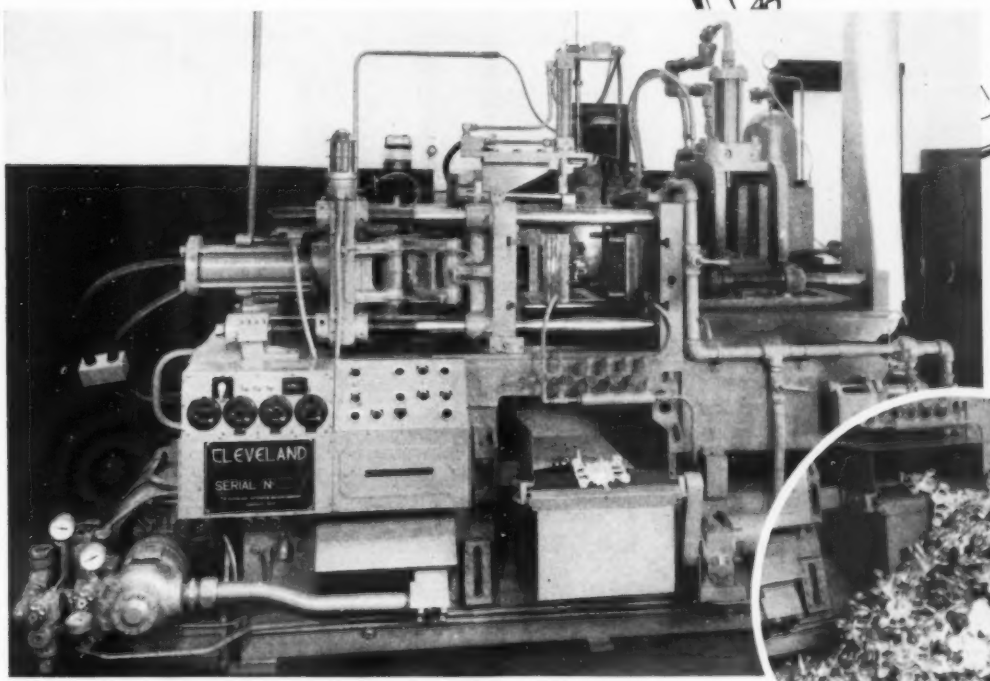
What are the advantages of this vacuum melted metal? They aren't fully realized yet. Better fatigue strength is one known gain. Better ductility is another. For example, a tool steel heat-treated to 300,000 psi ultimate tensile strength showed zero ductility when air melted and high ductility when vacuum arc melted. Impact strength is also improved though specific measurements are still to be made, but there is an improvement.

Present applications of vacuum-arc melted steels are mostly in the aircraft and missile fields. Costs are still somewhat high so that wider industrial use has lagged a little. Among the uses which are certain to develop will be the use of this steel for dies in die casting and forging. Because of the improved structure and the freedom from inclusions and flaws, dies with a far superior surface finish can be made. Such dies will produce castings which require less polishing and buffing to finish them and the die life should be increased since micro-cracks and inclusions act as stress raisers and are often the source of die failures. Present test work indicates that specific knowledge about improved die casting dies should be available in about a year.

FULLY AUTOMATED CLEVELAND

casts four perfect parts every seven seconds!





Here's die casting machine automation to the *nth* degree! The Cleveland shown above is in operation in our Die Casting Development Center, producing a gate of four zinc parts at a rate exceeding 500 shots per hour. This fast cycle operation includes casting ejection and conveying, plus automatic die lubrication.

Complete, fail-safe controls are incorporated. As an example, initial die closing uses low hydraulic pressure. If flash or other foreign matter of 0.012" or more thickness exists between the die halves, the die opens, stopping the cycle, and a signal light on the control panel indicates the source of stoppage. To speed set-up, all machine operating sequences are programmed by templates.

To die casters interested in cutting costs through automation, we extend a cordial invitation to schedule a visit to Cincinnati to see this machine in action. And this same invitation stands for those who desire to examine the industry's lowest cost, most efficient automatic aluminum ladling and vacuum die evacuation system in operation...for Cleveland has that, too!

THE CLEVELAND AUTOMATIC MACHINE COMPANY

4952 Beech Street
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Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

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See the latest in .....>

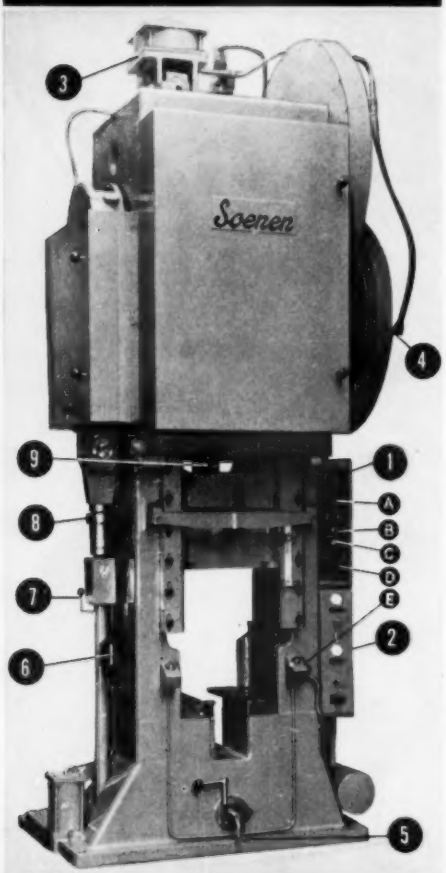
COMPACTING PRESSES using "Withdrawal Tooling"

A. Johnson & Company, Inc. offers modern presses in sizes between 6 and 1,100 tons. Some of their outstanding features are:

1. Allen-Bradley Electrical Controls (Nema 12 enclosure)
   a) single cycle-continuous cycle switch.
   b) automatic stop (T.D.C. position)
   c) emergency stop.
   d) forward-reverse motor control switch.
   e) quick acting inching control.
2. Separately housed pneumatic controls.
3. Quick acting pneumatic brake.
4. Synchronized pneumatic clutch.
5. Fill height adjustment crank.
6. Bejur central lubrication system.
7. Independent movement control for lower ram.
8. Turnbuckle sequencing die movement with upper punch.
9. Upper ram adjustment.

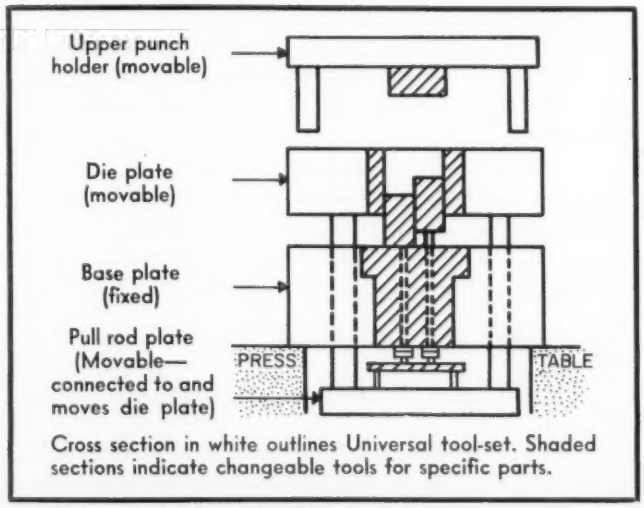
Other features not shown are: NEMA design "D" electric motor, shuttle type fill shoe and adjustable power drive, pneumatic spring or counter control of die, Sperry Products "Monitron" overload protection, Universal tool-set. Send for brochure describing complete details of presses and tooling.

Make an appointment for a press demonstration



MODEL 200T-50	
CAPACITY	220 TONS
MOTOR H.P.	25
MAX. STROKES/MINUTE	20
MAX. DIE FILL	6 INCHES

Our "Withdrawal Tooling" design enables tooling to be installed in the set on the bench resulting in minimum set-up time and therefore, a reduction of the overall down time of the press. With the interchangeability of tools in the Universal tool-set TOOLING COSTS ARE COMPARABLE WITH EJECTION TYPE TOOLING.



Cross section in white outlines Universal tool-set. Shaded sections indicate changeable tools for specific parts.

MEMBER METAL POWDER mpi INDUSTRIES FEDERATION

A. JOHNSON & COMPANY, INC.

21 WEST STREET • NEW YORK 6, N. Y.

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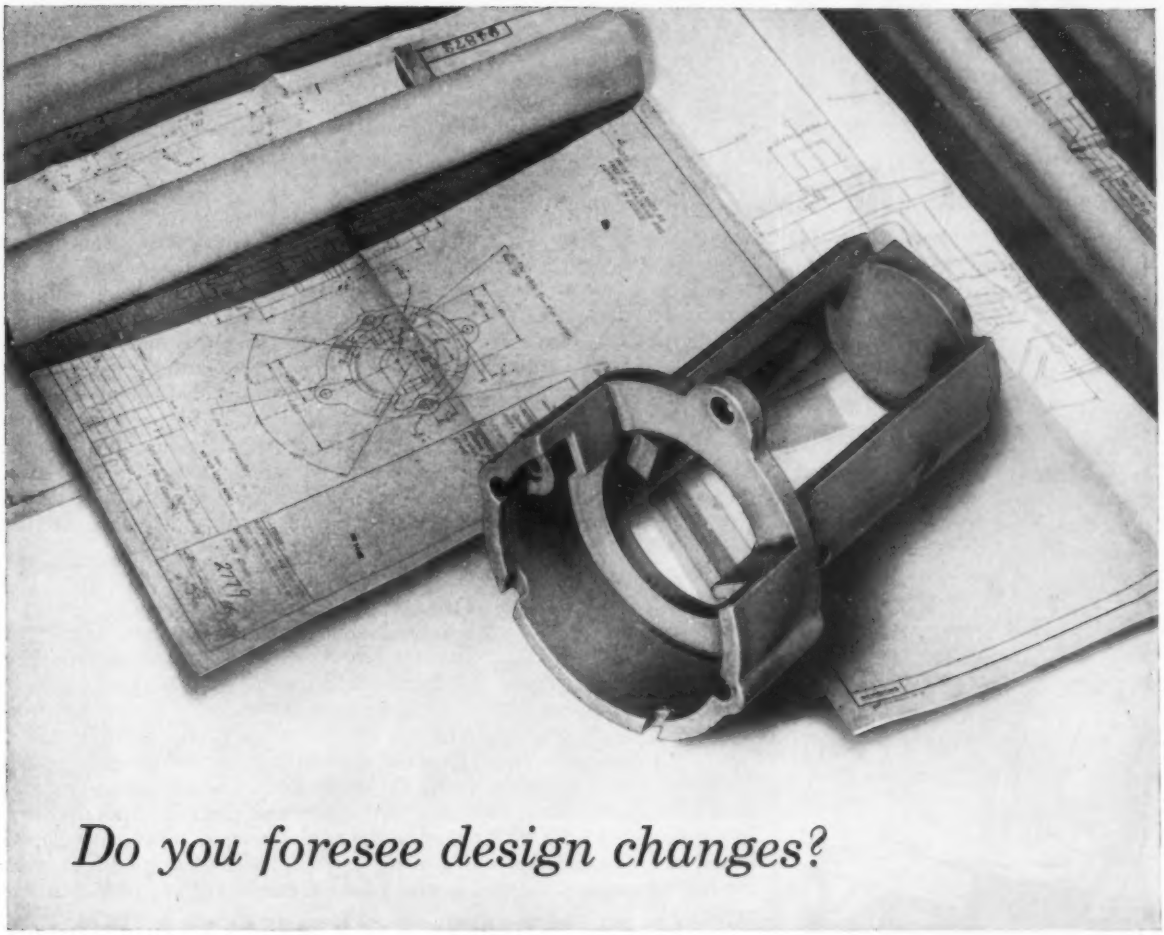

Do you foresee design changes?

...ask Arwood about investment casting

Investment casting offers you just about the most inexpensive, convenient way you can find to get your new part from the drawing board to finished, production line quantities. This is especially true when your design may involve some degree of complexity... a strong, tough alloy... time-consuming machining steps ... expensive tooling.

There are good reasons. With investment casting, tooling is quick and inexpensive. It's easy to modify finished dies as the need for design changes develops. Even more important, Arwood will handle the whole job for you, from blueprints through to the finished part.

It makes no difference what metal or alloy you specify; Arwood casts a complete range of ferrous and non-ferrous materials. The skilled toolmakers at each of our four foundries can turn out fifty or more dies each week. So to save time and cut your costs between the drawing board and finished parts, ready for assembly, get in touch with Arwood.

Write today for your free copy of the new 44-page Arwood "Practical Guide to Investment Casting." It provides all the information you need to evaluate the technique and use it to help solve your design problems.

MACHINE THE SIMPLE... CAST THE COMPLEX

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ARWOOD PRECISION CASTING CORP., 323 W. 44th St., N. Y. 36, N. Y.

A complete service from design through tooling, production and finish machining.
Sixty-two engineering consultants from coast to coast.

PLANTS IN BROOKLYN, N. Y.; TILTON, N. H.; GROTON, CONN. & LOS ANGELES, CALIF.

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CALL ME—

metallurgist
metals engineer
material specifier
product engineer
value analyst
designer
process engineer
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BUT CALL ME SMART

I'm Specifying
INVESTMENT CASTINGS MADE WITH *RxMET* CERTIFIED ALLOYS
from

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ALLOYS CO.
1999 GUOIN STREET
DETROIT 7, MICHIGAN
DIVISION of CONSOLIDATED FOUNDRIES & MFG. CORP.

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PMM BETWEEN THE LINES

The editor's viewpoint on articles in current and forthcoming issues

IN TODAY'S fast changing world the man, the company, or the industry which doesn't keep up with new developments is soon so far behind the competition that catching up becomes impossible. That's why we try to report all new work, not only in the fields of major editorial interest, but also in those fields where it seems that some effect will eventually be felt by the precision metal molding industries. Metal melted and cast in consumable-electrode arc furnaces is one example. Right now there is no direct evidence that any PMM industry will show a gain from these metals and alloys, but there's a good chance that improved die steels and better investment castings may result. There's a short report on the new vacuum melting furnace at Latrobe Steel Co. this month and a more detailed report on the steels made in this furnace coming. We have also started publication of the research reports of the ICI on both methods and materials, the one on AISI 410 stainless steel is in this issue.

PLATING ZINC DIE CASTINGS so that satisfactory corrosion resistance is secured has been a continuing headache for the automobile industry. A stress free chromium plate developed by the Udylite Co. was described in PMM some time ago (see PMM, July, 1958, pg. 39). This improved plating procedure was reported to give many times the corrosion resistance of ordinary plating. Now another, improved, system has been developed and is reported in this issue. Called Dual nickel plate, this report from the research laboratories of the Doehler-Jarvis Div. of National Lead Co. describes and shows both accelerated corrosion test results and outdoor exposure tests. In a subsequent issue we'll report on the dual chromium process developed by Metal & Thermit. According to reports, this latter plating scheme gives the best corrosion protection to zinc base die castings of any process so far presented.

TOOLING is one of the major expense items which must be considered when a new part is designed or an old one redesigned. There are many methods of fabricating which will cut manufacturing costs if the per piece tooling cost is not too high. The manufacturers of machine tools recognize this and build into their machines as much flexibility as possible so that tooling for the individual part may be kept as simple as possible. All of the manufacturers of powder metal presses have recognized this and have designed their presses with multiple upper and lower rams, floating die tables, side compression devices and many other features so that tooling can be inexpensive. An example of how complex the presses have gotten to allow simple tooling is given in the article by the Kux Machine Co. in this issue.

INDUSTRY STANDARDS are not set up strictly for the benefit of the parts fabricator. The design engineer who follows established standards will get a better part at the lowest possible cost. He'll also find out that rejects are far lower. Another advantage will come in more uniform quotes when a part is put out for bids. If dimensioning, tolerances, inspection methods, etc. follow the established industry standards, all of the vendors will be bidding on a common basis. The Investment Casting Institute, through its member companies, has established a number of standards and is constantly working on the development of others. The latest standards, which are appearing in PMM in three parts, started last month with Part I, covering purpose, surface quality, and X-ray standards. This month, Part II covers visual standards and penetrant and magnetic particle inspection. The conclusion, Part III, will be published next month. It will describe the inspection standards set up for airfoil sections.

At San Jose Die Casting

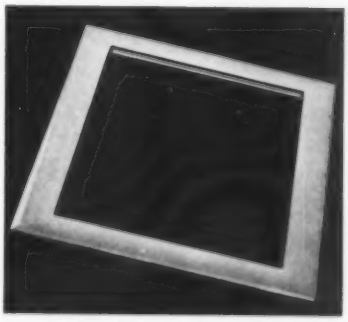
REED VACUCAST CUTS REJECT RATE BY 90%

produces higher quality, lower cost zinc castings

"I'm fully convinced that the REED Vacucast unit is a real business builder, an absolute must in assuring customers the highest quality, lowest cost zinc castings available," says William H. C. Bartlett, President of San Jose Die Casting, San Jose, California.

"Our customer, a large manufacturer of lighting fixtures, experienced a great deal of difficulty in obtaining high quality hardware finish castings. The reject rate was running well over 10%. Since we have been producing these parts on the Vacucast, rejects have been less than 1%. This has meant a considerable cost savings, since the rejects were not apparent until after the polishing and plating operations were completed. Parts now require only one buffing operation with a cotton wheel before plating. Particularly important is the absence of porosity along the trim line, which had formerly caused plating failures."

REED Vacucast gives you many advantages: thinner wall sections, improved finishes, increased cycling time, and a much lower reject rate. And the cost of adapting existing tooling to the unit is very nominal. For complete information about the REED Vacucast system call your nearest REED Sales Engineer today.



One of two lighting fixture units produced on the Reed-Prentice 1½ Zinc Vacucast Machine.

REED-PRENTICE

.....division of

PACKAGE MACHINERY COMPANY

EAST LONGMEADOW, MASSACHUSETTS

BRANCH OFFICES: NEW YORK • CHICAGO • BUFFALO • DAYTON • DEARBORN • KANSAS CITY • LOS ANGELES

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MICRO-CARBIDE
Tool & Die Company, Inc.

DESIGN & BUILD TOOLS AND DIES
for the
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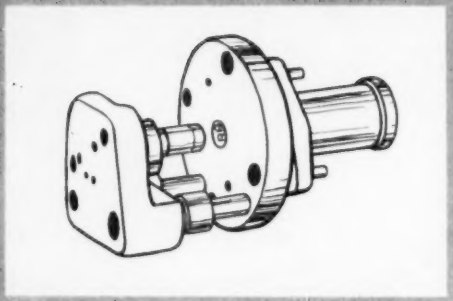

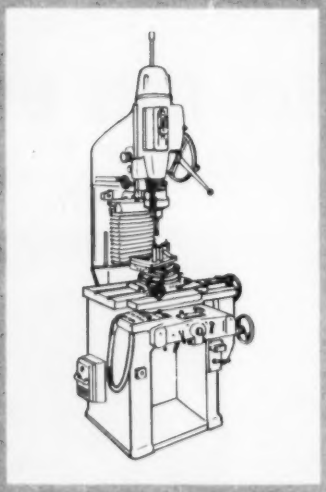

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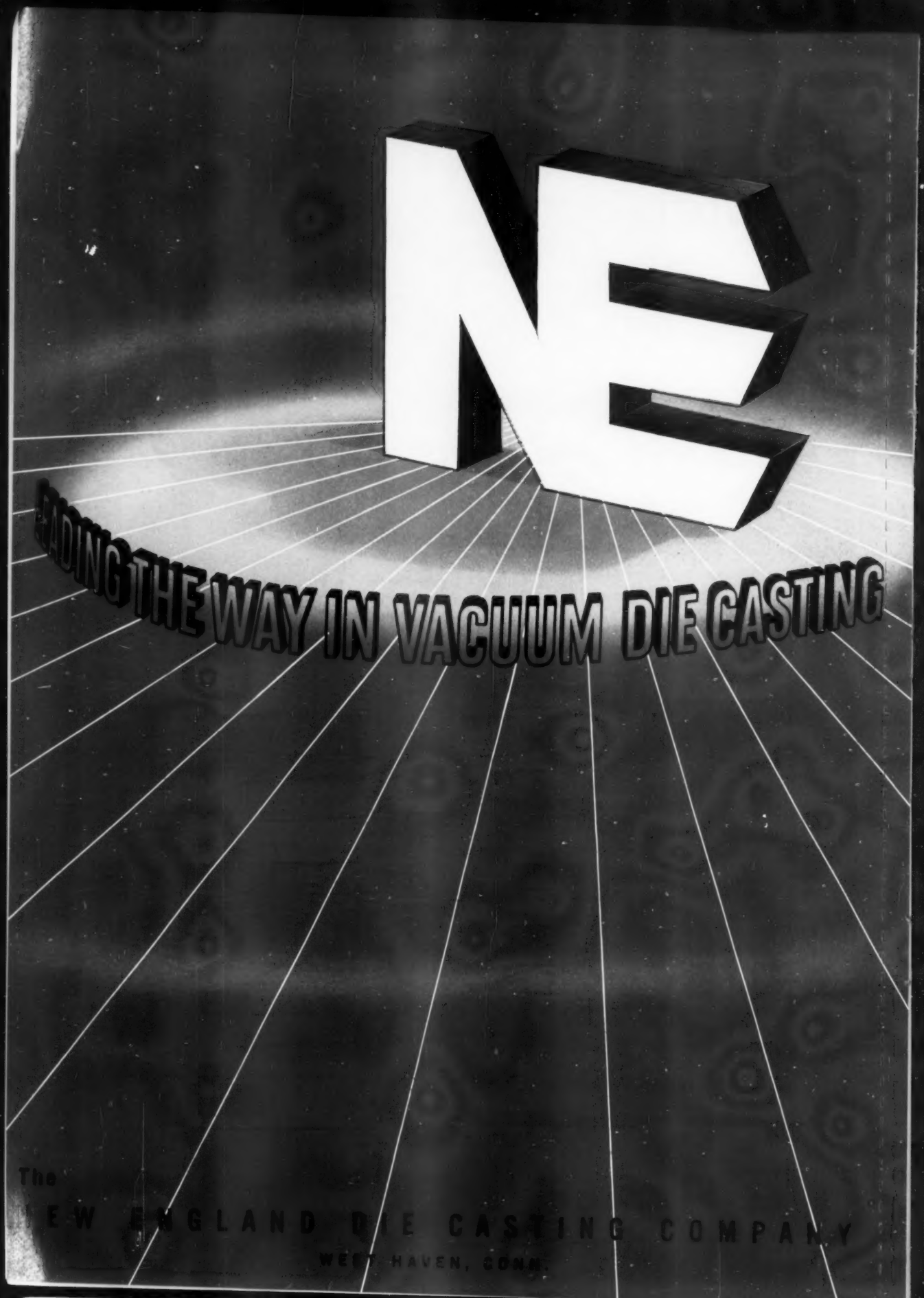
NE
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New High-Strength Aluminum Alloy

X357 is a high purity silicon-magnesium-titanium alloy of aluminum developed by Kaiser Aluminum & Chemical Co. By holding the iron content below 0.15%, the beta phase iron-silicon intermetallic compound is reduced to such an extent that its embrittling action is absent. The result: The high tensile strength and high yield strength of the primary alloy of aluminum, silicon and magnesium can be developed fully and good elongation of the as-cast alloy secured.

The specifications and a typical analysis of a casting heat are given in Table I.

This alloy can be both sand and permanent mold cast. It also can probably be investment cast. It has good casting properties at from 1300°F to 1320°F. When permanent mold cast, the average mold temperature should be about 625°F.

The best solution heat treatment found so far is to soak at 1000°F to 1010°F ± 5°F for twelve hours, then quench in water at 180°F minimum. Age for 6 hours at 350°F. When heat treated in this way the average mechanical properties are given in Table II.

Aging time and temperature have a pronounced effect on the mechanical properties of this alloy. The effects of time at constant temperature and temperature at constant time are shown in Figures 1 and 2. These curves are for permanent mold cast test specimens. Sand cast bars respond similarly, but at lower levels for ultimate tensile strength and elongation.

The new alloy should find wide use in the aircraft and missile fields.

TABLE I

COMPOSITION AND SPECIFICATION OF X357

Element	Specification %	Typical Analysis %
Cu	0.05 max	0.007
Si	6.5 - 7.5	7.02
Fe	0.15 max	0.11
Mg	0.45 - 0.60	0.54
Zn	0.03 max	0.01
Mn	0.03 max	0.002
Ti	0.10 - 0.20	0.16
Others (each)	0.03 max	
Others (total)	0.10 max	
Al	Bal.	Bal.

TABLE II

MECHANICAL PROPERTIES OF ALLOY X357—T6

Tensile Strength psi	Yield strength 0.2% offset, psi	Elongation % in 2 in.	Remarks
52,000	43,000	5.0	Permanent mold cast
50,000	43,000	2.0	Sand Cast

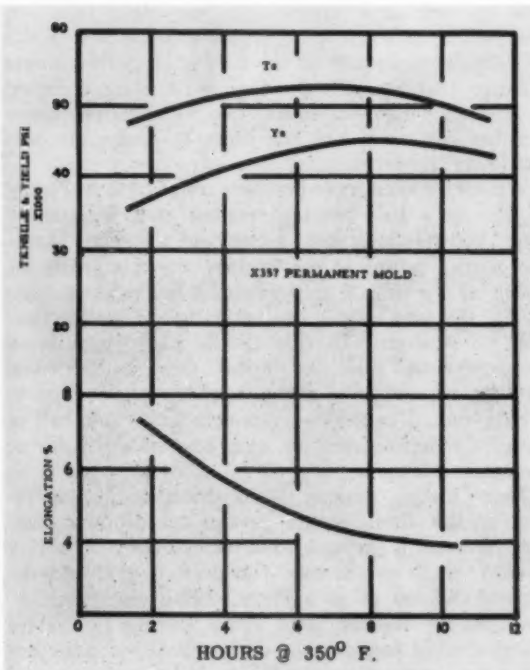

FIGURE 1.

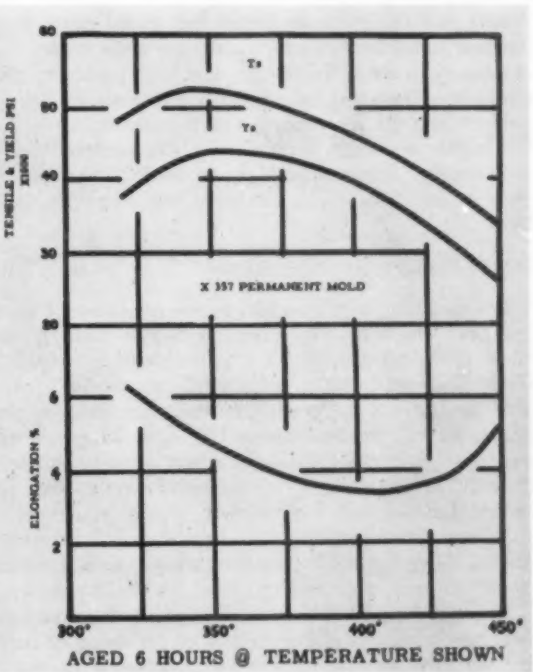

FIGURE 2.

Compacting Presses and Tooling Systems

. . . for powder metallurgy parts

By JAMES J. KUX*

THE CORE of manufacturing by powder metallurgy around which all else is dependent, is the tooling. Usually, success or failure in the production of a part can be traced to the design of the compacting tools.

The tools, however, can produce nothing. The press in which they are mounted becomes equally important. It contributes the needed power and provides alignment, timing and sequencing for the individual tool components.

Therefore in discussing tooling systems, we must also discuss presses.

Keep in mind that powders under pressure do not behave like fluids nor follow hydrodynamic laws. So, in producing powder-metal parts, the movement of the pressing tools is utilized to move the powder, where and when necessary.

Now, in considering the design of tooling for a complex powdered metal part, the press that is available will determine the construction and operation. If only a simple motion press is at hand, it may be necessary to design the tools with floating sections, spring controlled, or even with built-in air cylinders for moving components. If a multiple motion press can be used, the tooling might become simpler.

Another important consideration is alignment between tool components. Powdered metal parts have become considerably more accurate with closer tolerances than a few years ago. The high pressure, long stroke machine can't be relied upon to provide lasting, perfect line up between die and punches. Thus, for the highly accurate parts, leader pin construction is a necessity. Some presses have leader pin guiding built in, and the tools do not need this added mechanism.

SIMPLE MOTION PRESSES

Let us take a look at a simple motion press (Figure 1). This single punch, eccentric driven type of machine is widely used in the production of the smaller, simple, or semicomplex parts at a high rate of speed. The tooling for this press normally consists of one upper punch, one stationary die, one lower punch, and any core rods needed for the part being produced. The sequence of operation is simple, with set timing that can only be varied by changing cams.

Adjustments for die fill, upper punch pressure stroke, lower punch pressure stroke and ejection stroke, as well as operating speed, are easily made.

This machine has single-cycle control. It is particularly advantageous if a press is used for sizing or coining parts, when the part being handled is manually placed and removed from the die table at each operation of the press.

A majority of these presses provide for ejection of the formed compact by the lower punch. Some machines are being utilized that are constructed with a withdrawal method of ejection. The action uses a movable die table and a stationary lower punch. After the die cavity has been filled with powder, the upper punch travels down and enters the die. At this time, the die table also moves down, simulating lower punch pressure action. Once compression of the compact has been completed, the upper punch moves, but the die table continues down, and the compact on top of the lower punch is finally fully exposed and then pushed away by the feed shoe. Movement of the table allows the die cavity to fill.

These machines normally use simple tools, but it is possible to produce complex parts on them by designing the tools for the required motions. Figure 2 shows tooling for a cluster gear, or gear pinion combination for which a floating, spring-loaded die is required.

Figure 3 shows how multiple punch tooling can be used on simple motion presses by building the necessary punch and die movements into the tools. This compact has varying sectional thicknesses, and an inner, lower secondary punch is used for compression as well as ejection. This secondary punch is operated by a telescoping lever mechanism that can be considered as part of the tooling. Figure 4 shows a flange bushing with the required tooling designed in a similar manner. Again, two independent lower punches are used, but the press basically has only one lower, power ram.

We see an even more complex set of tools in Figure 5. This is a ball bearing retainer ring with every other ball-retaining hole having an alternate shape, one with a radius at the bottom, the next with the radius at the top. A spring-loaded holder containing half of the core rods is needed to hold movable core rods which, during filling of the die cavity, stay in an up position, but which are pushed down and replaced during compression of the powder by core rod extensions mounted to the upper punch. The other half of the rods remain stationary, as is conventional, during the entire cycle.

These tooling designs demonstrate that, using ingenuity, the simple motion presses can produce complex parts, with spring-loaded tool sections imparting needed punch movements. However, it is always extremely difficult to gain these tooling section movements at the desired time, either during the cavity filling, during pressing, or during final ejection. Reliance on spring power in the tools for movement of tool components not only complicates tool construc-

*KUX MACHINE CO.

tion (for there never is enough room for proper size of springs) but creates a condition where a change in either timing or stroke, or both, occurs, from cycle to cycle, due to more or less sliding friction between the tool sections; the formed compacts thus deviate in either density or dimensional requirements.

MULTIPLE MOTION PRESSES

This leads us to the cam operated, multiple punch, multiple motion presses (Figure 6). To produce the intricate, varying sectional-thickness compact, the multiple motion press will still require complex tooling, but no dependence is placed on springs for moving the tool sections, for the press is constructed with the mechanism for providing the punch and die motions desired, both stroke and timing.

Two upper punches are provided, the secondary punch operating inside the main punch and each independently controlled. Used primarily for applying pressure, they are also needed, in many cases, for relocating the material before pressing, as well as for ejection purposes.

Two lower independent punches are provided, both of which are normally used for applying pressure and for ejection. A stationary core bracket, for holding one or more stationary core pins, is also built into all of the presses. On some models, side core pulling devices are available, so that a horizontal hole or counterbore can be produced in a part.

Each punch, whether upper or lower, is independent of the others and has its own separate stroke adjustment for pressure and/or ejection.

These multiple motion presses also have an overfill device insuring uniform filling of the die cavity. This device, by dropping the level of the material in the die cavity before the pressing cycle takes place, prevents material loss and variation normally caused by the spraying of material into the air which, on other machines, occurs as the upper punch enters the die cavity.

Figure 7 is a design for multiple tools for producing a tube having a counter bore both at the top and the bottom. Two independent upper punches are used, two independent lower punches, a stationary die, and a stationary core rod.

For making long, thin-walled parts, air pressure is

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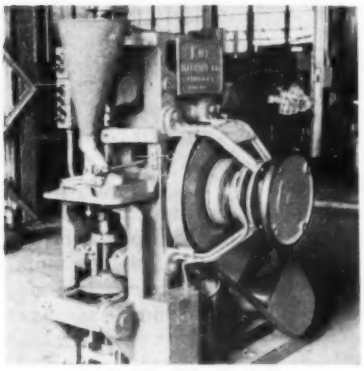
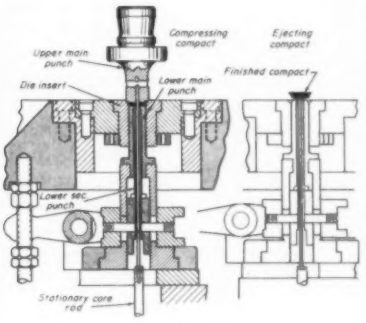


FIGURE 1.



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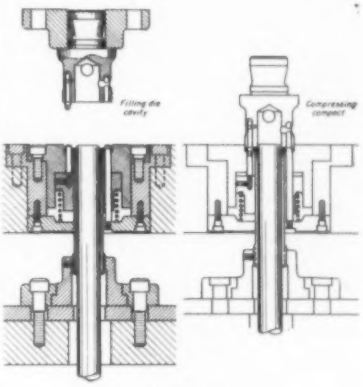


FIGURE 5.

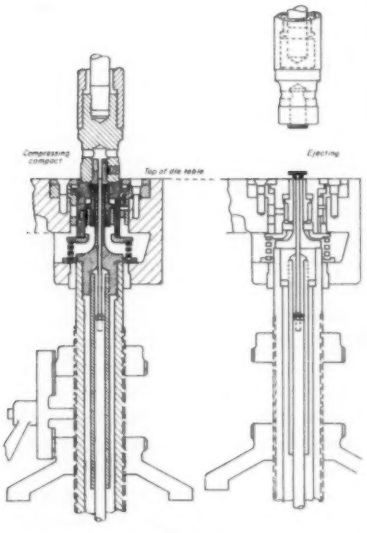


FIGURE 2.

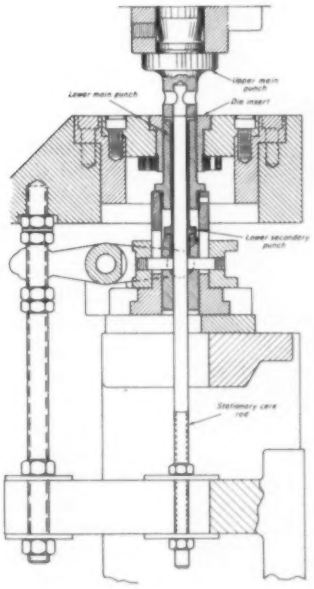


FIGURE 4.

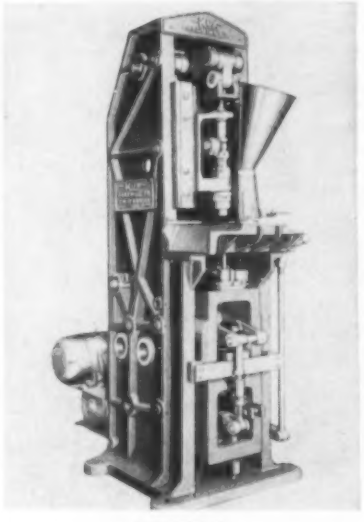


FIGURE 6.

used to control a movable or floating core rod mechanism. In the production of a long bushing, the core rod would be in a down position during the filling of the die with powder. Then, while the feed shoe remains over the die cavity, the core rod is moved up through the loose powder, pushing the excess powder back into the feed shoe, insuring even filling around the core rod. After forming pressure applied by both upper and lower punches, the compact is ejected upwards by the lower punch, and the core rod floats up with it above the die table. With the compact out of the die cavity, side wall friction is relieved, and the core rod retracts to its down position.

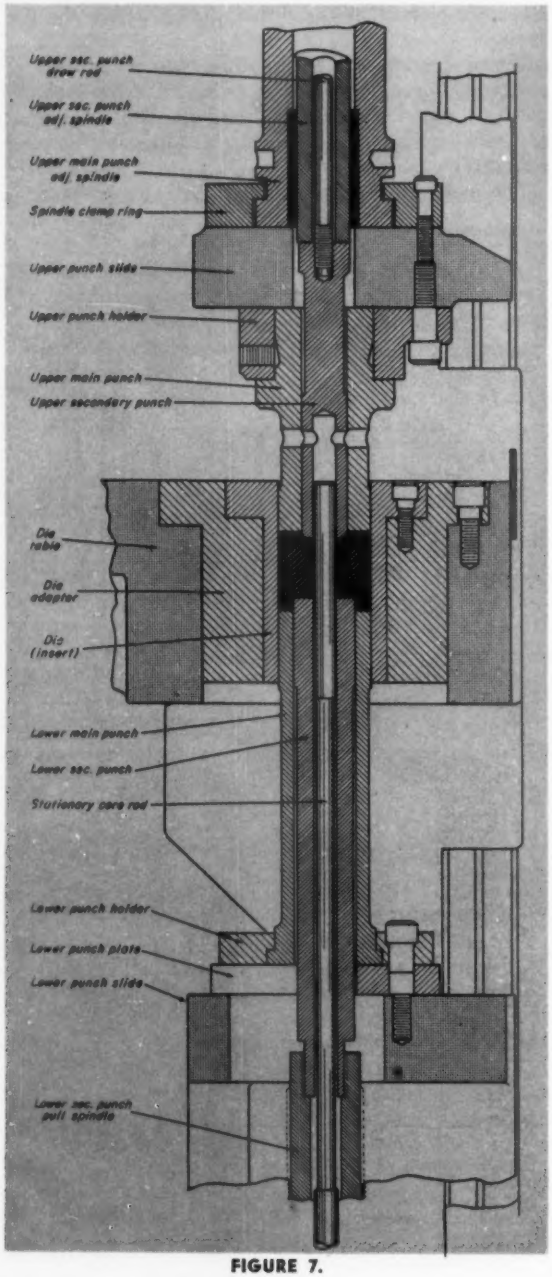


FIGURE 7.

Highly versatile presses are built today. Presses which can take simple or complex tools and move the respective components when, how, and where desired during filling, pressing or ejecting, without the need of springs, friction pads, special cams, die sets, air cylinder or mechanical lever devices.

HYDRAULIC PRESSES

Hydraulic presses (Figure 8) have the capacity to produce even the most complex part, rapidly and accurately, with all needed adjustments for die fill, pressure, ejection and timing sequence controlled simply and quickly the modern way — electrically and hydraulically at a control panel.

Since hydraulic cylinders move the upper and lower punches, it is possible to adjust these tools to come to a pressure stop position, applying the desired exact pressure to the compact being formed and holding a true density, even with slight variation of the die fill.

A positive mechanical stop bar mechanism is, however, incorporated as well, so that the upper and lower punches traveling through their pressure stroke will come to a positive mechanical stop position, thus holding the desired dimensional thickness of the compact being formed. This stop bar unit is adjustable to permit the maximum to minimum thickness of compact to be made.

A completely new design innovation is the use of leader pin guide bars for maintaining perfect alignment between the upper punch and die, as well as lower punch and die. The guide bars, accurately mounted to the upper and lower punch holding plates, travel at all times in combined ball-bearing hardened steel bushings located in the die table. Thus, close tolerance parts can be made, with punch breakage due to misalignment kept at an absolute minimum.

Figure 9 illustrates a multiple punch, multiple motion hydraulic with a secondary lower punch mechanism having full die fill, ejection and pressure stroke.

As the pressure requirements for the secondary lower punch are usually far less than the main lower punch, it is rated for one-half or less of the machine tonnage. However, it has its own complete set of adjustment controls and can be timed to operate during the pressing or the ejection stroke of the lower punch, simultaneously, or at a different time to suit the compact being produced. Thus, different pressures can be applied to different, varying sections of a compact, which can be ejected from its lowest surface without either punch protruding above the die table.

Timing on these presses is extremely flexible and an infinite change of timing sequence can be readily obtained for production of intricate, varying sectional-thickness types of compacts. For example, the machine can be timed so that the upper punch will penetrate the die cavity, apply pressure, and then stop. At the end of this upper punch stroke, the lower punch would then start to rise and apply its pressure from the bottom. After a time delay, while the compact is held under pressure (the delay can be varied from 0 to 20 seconds), the upper punch rises and the lower punch rises farther to eject the formed part.

A different sequence is one of having the upper punch travel down and enter the die cavity, then the lower punch starts rising to apply pressure. There-

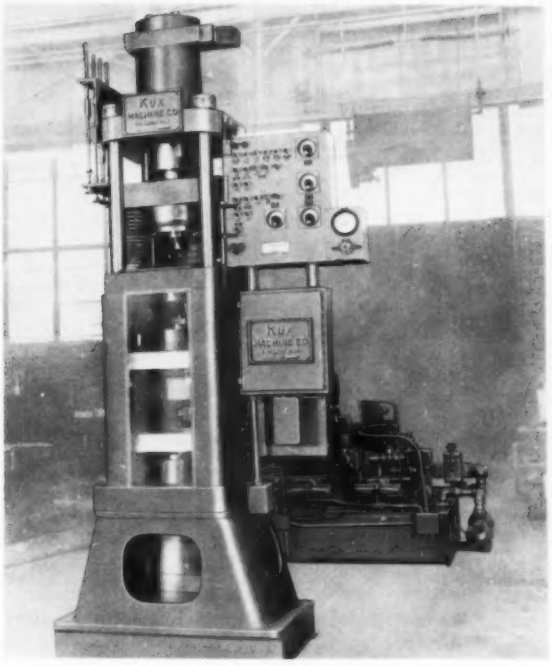


FIGURE 8.

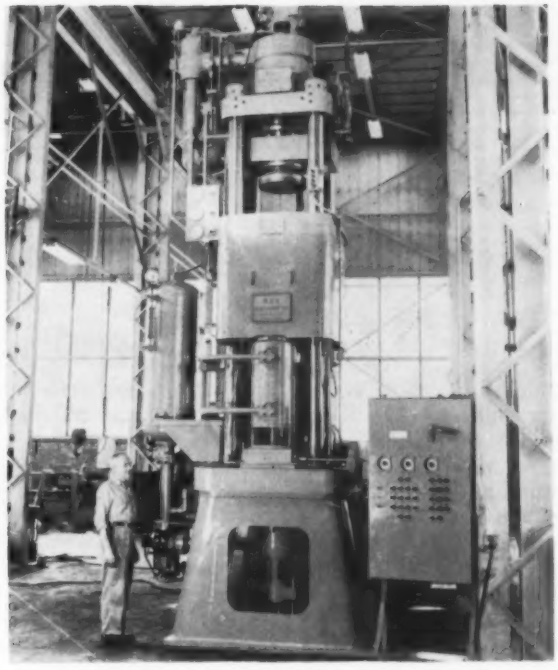


FIGURE 9.

fore, both punches simultaneously approach each other during the pressing period and, after finally coming to their final stop position, the upper punch reverses its stroke, rising while the lower one remains stationary during a time delay and then rises to eject the formed tablet.

A third timing sequence can be used when the lower punch has a slight projection on it. After the pressing sequence, the lower punch would rise to eject the formed tablet and actually move above the die table surface. The feed shoe is held in its back position, while the compact is picked off the die table by an operator. Then the lower punch travels down to bring the projecting part of the punch below the top surface of the die table. The lower punch stops until the feed shoe is moved over the die cavity. The lower punch moves to its full down position, pulling the powder down by suction from the feed shoe into the die cavity.

In addition, it is possible to increase overall press operating speed by utilizing a rapid approach of the upper punch as it travels through space and then a slow movement during its penetration into the die cavity, which also tends to reduce spraying of powder into the air.

Again, many fragile compacts have a tendency to fracture during ejection. To avoid this, the lower punch rises simultaneously with the upper punch to keep the compact between both punches until it is almost out of its cavity. When this action is required, it is a simple matter to so adjust the press timing.

When desired, a movable die table mechanism is supplied with a floating die unit supported by two hydraulic cylinders. The resistance pressure of these cylinders can be adjusted to allow the die to move downwards during the upper pressure stroke, the distance required by the compact being formed. These cylinders then provide a positive return of the die to its up position, during or after the ejection sequence of the lower punch.

Some compacts need to be formed from two different materials, and this is accomplished through use of a second, independent feed shoe and hopper (Figure 10). A simple change of the lower punch timing sequence provides an initial fill. The lower punch then drops and powder from a second shoe feeds different material into the cavity. The compacting and ejecting sequence is unchanged.

It is possible to provide a third feed shoe and hopper for producing a three layer compact.

Most producers of metal powder parts try to have a good balance of both single and multiple motion equipment so tooling construction is kept simple and inexpensive. Also, maintenance problems are reduced and yet they have presses that enable them to make a complete range of powdered metal parts.

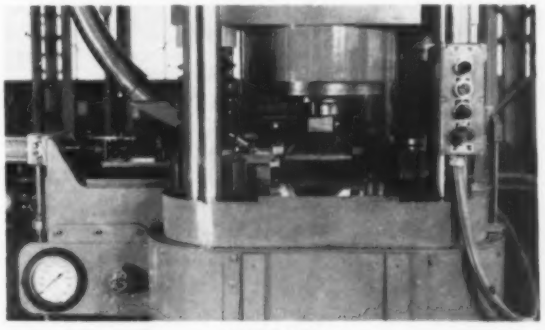


FIGURE 10.

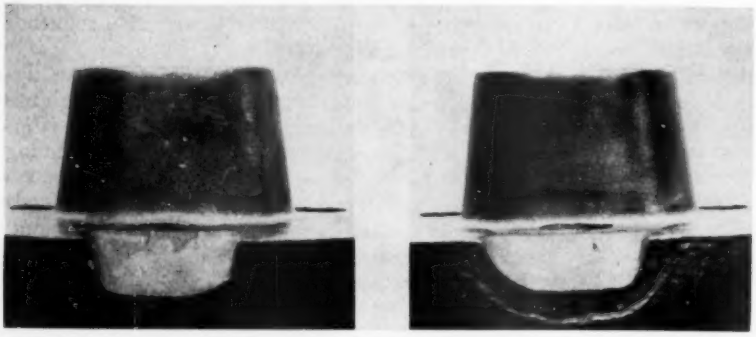
Molybdenum Die Casting Dies

Editor's note — Die casting dies are expensive. That's why anything which will increase die life is of great importance to both the fabricator of parts and to the purchaser of die castings.

There are three principal causes of short die life. Soldering, heat checking, and mold wash. All of these increase in severity as the temperature of the metal being cast increases. Normally, zinc does not present much of a problem except where a hardware finish must be maintained. In these cases, frequent polishing may have to be done.

With aluminum, brass, bronze, magnesium, and steel, die life is a highly important factor and any appreciable increase is immediately reflected in lowered parts costs. Steel and most of the bronzes are not, of course, being die cast at present. This is almost entirely due to lack of adequate dies.

Research into die materials for the high temperature metals has led two independant activities to the same end result — molybdenum. The General Electric Co. has been investigating molybdenum dies made by powder metallurgical methods. Their work is still in the research and development stage, but, as the following report indicates, the molybdenum dies have already shown considerable promise in the die casting of brass. The American Die Casting Institute through its research work at Battelle Memorial Institute has announced the development of an improved core material, again molybdenum, but in this case vacuum cast. The ADCI report on their work also follows.



CORES OF EJECTOR inserts after making 5,000 brass castings. Left, a standard steel core; right, unalloyed molybdenum core.

TABLE I

Properties of Some Alloys Evaluated for Resistance to Heat Checking

	Thermal Expansion 10^{-6} in/in/°F	Thermal Conductivity BTU/ft²/in/°F/hr	Hardness, DPH		Resistance to Heat Checking
			Room Temp.	1500°F	
Standard Die Steel	7.3	About 180	450	30	Fair
Low Expansion Ferrous Base Material	13.6	Less than 90	285	42	Exceedingly Poor
Molybdenum Alloy (with titanium) (cold worked)	3.2	About 745	259	131	Very Good

GENERAL ELECTRIC RESEARCH REPORT

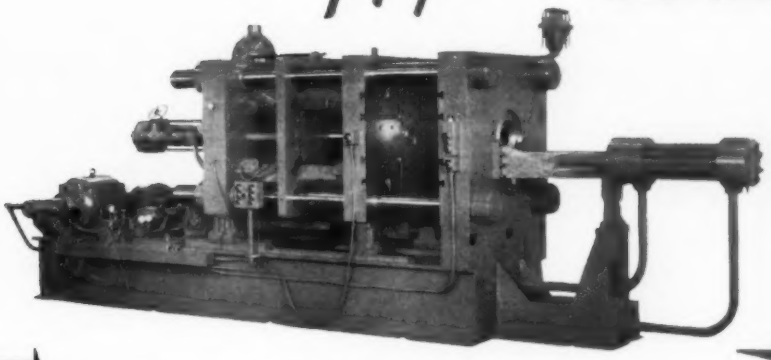
Products made from sintered molybdenum are now being developed by General Electric Co. for use in die casting cores and cavities. Engineering and applications work is being carried out by the Lamp, Metals and Components Department in Cleveland and includes the use of pure molybdenum and a variation of the pure metal which show promise in the critical materials areas.

Sintered molybdenum is manufactured by powder metallurgical techniques in contrast to the vacuum arc melting process. The metal powder process includes the consolidation of metal powder by pressing, followed by high-temperature sintering. Material is then densified by swaging, rolling, forging, and other techniques in which the molybdenum is worked.

Preliminary field testing results within General Electric during the past 15 months indicate that sin-

continued on page 52

The STANDARD *Hydraulic* SYSTEM OF B & T DIE-CASTING MACHINES



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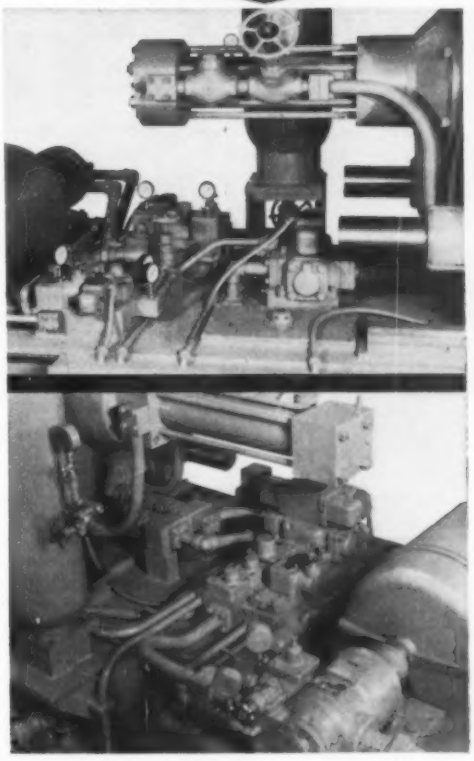

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Effect of varying tempering temperatures on . . .

Mechanical Properties of Investment Cast 410

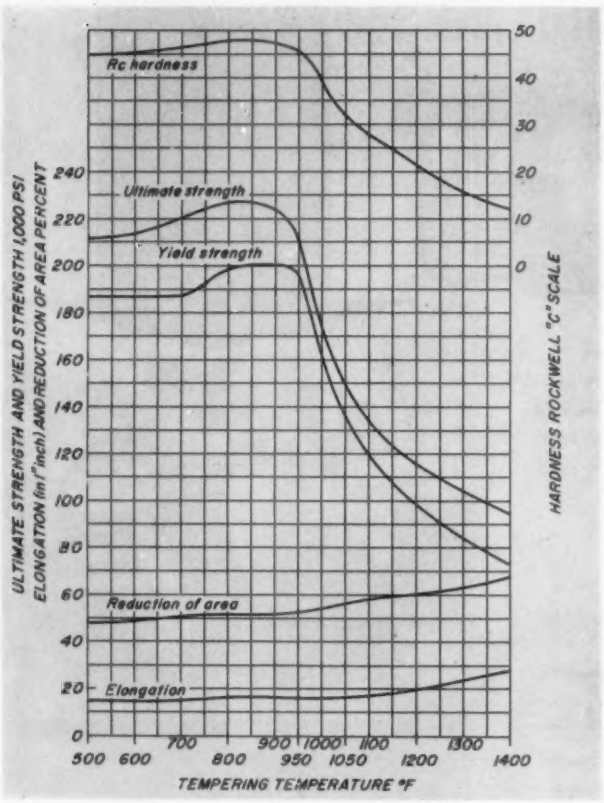
Rc hardness
Ultimate strength
Yield strength
Reduction of area
Elongation
ULTIMATE STRENGTH AND YIELD STRENGTH 1,000 PSI
ELONGATION (in 1" inch) AND REDUCTION OF AREA PERCENT
HARDNESS ROCKWELL "C" SCALE
TEMPERING TEMPERATURE °F
500 600 700 800 900 950 1000 1050 1100 1200 1300 1400
0 20 40 60 80 100 120 140 160 180 200 220 240
0 10 20 30 40 50

FIGURE 1.

By W. FRED CARN*

THE INVESTIGATION described here was undertaken to determine the effect of varying tempering temperatures on the mechanical properties of investment cast A1S1 410 stainless steel, with time at tempering temperature held constant.

The results can be used to compare the mechanical properties of investment cast 410 stainless with other forms of this material. This data also can be used in selecting the proper heat treatment for obtaining certain required properties.

For testing purposes, 11 flasks were invested, with four center-gated test bars in each flask. Procedures involved and other related information were as follows:

- Precoat: Nalcoag bonded precoat using PV 411 powder.
- Investment: Pre-Vest's PVF-147.
- Flask Temperature: Burned out at 1800 F. Temperature was dropped to 1400 F for casting.
- Melting Equipment: 20 KVA mercury arc converter, Ajax induction unit, with 17 lb capacity magnesite crucible.
- Melting Practice: No additions were made to the melt, until just before pouring, when one teaspoonful of calcium silicon and four pellets of aluminum were added. Metal temperature was 2950 F at time of cast.
- Metal: WaiMet 410 stainless steel shot, heat Rx 41-307.

Two 14# melts were made, from which four flasks

continued on page 36

*PRECISION METALSMITHS, INC.

TABLE I
ANALYSIS OF PRIME

	Percent
Carbon	0.13
Manganese	0.44
Phosphorus	0.004
Sulphur	0.022
Silicon	0.64
Chromium	13.50
Nickel	0.32
Molybdenum	0.06
Copper	0.05

TABLE II
ANALYSIS OF THREE HEATS, AS CAST

	1st heat	2nd heat	3rd heat	Average
Carbon	0.09	0.11	0.12	0.11
Manganese	0.29	0.27	0.19	0.25
Phosphorus	0.016	0.018	0.023	0.02
Sulphur	0.024	0.27	0.028	0.03
Silicon	0.52	0.43	0.38	0.44
Chromium	12.77	12.51	13.10	12.79
Nickel	0.22	0.25	0.29	0.25
Molybdenum	0.08	0.09	0.09	0.09
Copper	0.03	0.04	0.05	0.04

TABLE III

EFFECT OF TEMPERING TEMPERATURES

	Ultimate Tensile Strength p. s. i.	Yield Strength p. s. i.	Elongation in 1" %	Reduction of area %	Rockwell C & B Hardness	
Drawn 500°F	213,000	187,800	16.0	50.5	44-46	RC
	212,000	187,200	16.0	47.1	44-46	RC
	212,000	187,600	14.0	48.1	44-46	RC
	210,000	186,900	15.0	53.0	44-46	RC
Average	211,750	187,375	15.25	48.925	45	RC
Drawn 700°F	220,000	185,200	16.0	48.7	46-47	RC
	221,000	188,800	15.0	52.9	46-47	RC
	222,000	185,800	16.0	50.8	46-47	RC
	219,000	188,900	15.0	52.4	46-47	RC
Average	220,500	187,175	15.5	51.2	46.5	RC
Drawn 800°F	227,000	197,800	16.0	50.7	47-49	RC
	227,500	198,600	16.0	52.3	47-49	RC
	2 bars broke prematurely at flaw in shoulder					
Average	227,250	198,200	16.0	51.5	48	RC
Drawn 900°F	223,000	197,100	17.0	52.0	46-49	RC
	224,000	198,600	17.0	53.6	46-49	RC
	221,000	201,500	16.0	53.4	46-49	RC
	223,000	203,000	16.0	47.8	46-49	RC
Average	222,750	200,050	16.5	51.7	47.5	RC
Drawn 950°F	218,000	196,900	17.0	54.5	45-47	RC
	219,000	197,200	18.0	56.2	45-47	RC
	220,000	198,300	17.0	51.1	45-47	RC
	216,000	197,000	17.0	54.0	45-47	RC
Average	218,250	197,350	17.25	53.7	46	RC
Drawn 1000°F	174,800	165,500	16.0	59.7	36-41	RC
	177,000	166,300	15.0	54.6	36-41	RC
	176,800	163,100	13.0	44.1	36-41	RC
	177,000	164,300	17.0	56.8	36-41	RC
Average	176,400	164,800	15.25	53.8	38.5	RC
Drawn 1050°F	144,600	129,100	18.0	59.8	29-33	RC
	145,000	128,200	18.0	60.1	29-33	RC
	145,200	131,900	17.0	60.8	29-33	RC
	146,300	135,900	17.0	50.4	29-33	RC
Average	145,225	131,225	17.5	57.775	31	RC
Drawn 1100°F	137,000	123,300	18.0	49.5	27-31	RC
	138,600	122,100	19.0	60.8	27-31	RC
	136,700	122,900	20.0	62.8	27-31	RC
	137,000	122,000	19.0	61.5	27-31	RC
Average	137,325	122,325	19.0	58.65	29	RC
Drawn 1200°F	118,900	102,800	20.0	61.5	21-25	RC
	116,200	101,100	20.0	61.4	21-25	RC
	119,200	101,900	22.0	61.9	21-25	RC
	116,900	101,300	20.0	61.6	21-25	RC
Average	117,800	101,775	20.5	61.625	23.5	RC
Drawn 1300°F	103,100	83,400	25.0	64.6	RB	94-98
	105,200	83,200	24.0	61.9	RB	94-98
	105,000	83,500	22.0	63.7	RB	94-98
	103,100	83,300	24.0	63.0	RB	94-98
Average	104,100	83,350	23.5	63.3	RB	96
Drawn 1400°F	95,300	72,400	30.0	67.6	RB	92-94
	95,400	73,600	27.0	66.7	RB	92-94
	95,400	74,700	28.0	65.3	RB	92-94
	97,300	74,700	30.0	68.4	RB	92-94
Average	95,850	73,850	28.75	67.0	RB	93

HYDRAULIC SAFETY BULLETIN

IMPROVED FIRE-RESISTANT UCON HYDROLUBES QUICKLY, EASILY INSTALLED IN HYDRAULIC SYSTEMS

Standard flushing and refilling procedures are sufficient for Ucon hydrolube safety hydraulic fluids.

Most hydraulic systems can be quickly and easily converted to fire-resistant Ucon hydrolubes from flammable petroleum oils or synthetic fluids. Actual experience, in hundreds of industrial installations, shows that standard flushing and refilling procedures, involving a minimum of time and effort, are sufficient.

Installation Procedure

The procedure generally followed in converting to Ucon hydrolubes from petroleum hydraulic fluids is:

1. Drain the petroleum oil from the system and remove residual sludge and deposit.
2. Flush the system with Ucon hydrolube.
3. Install a clean filter and replace any worn pump parts and deteriorated gaskets, seals, or packings. Repair leaking pipe joints.
4. Operate at reduced pressure to insure proper lubrication of the hydraulic pump; then, bring the system up to standard operating conditions.

Experience also shows that, once installed, Ucon hydrolubes require a minimum of maintenance because the tendency to creep through pipe fittings and along pump shafts and cylinder rods is often significantly less than with other types of fluids.

FIRST FEW WEEKS IMPORTANT

During the first few weeks of operation, filters and inlet screens may sometimes become clogged by sludge and other unwanted deposits loosened by the solvent action of the hydrolube. Since stoppage may cause pump starvation and cavitation, noisy operation, and high pump wear, filter cartridges should be replaced and inlet screens cleaned as often as needed.

When replacing non-aqueous, fire-resistant fluids with Ucon hydrolubes care should be taken to remove all of the previous fluid from the hydraulic system. This can best be done by draining the non-aqueous fluid from the system, flushing with a petroleum hydraulic oil and then following the installation procedure previously outlined.

FIRE-RESISTANCE PROVED BY TESTS

The common fire hazards connected with hydraulic operations are eliminated when Ucon hydrolubes are used. This has been proved by tests and more than 10 years of routine use in industrial hydraulic equipment. Ucon hydrolubes are approved by Factory Mutual Laboratories.

Get all the facts on Ucon hydrolubes. Write for the booklet, "Ucon Hydrolubes Spell Safety." Address . . . Department B.

UNION CARBIDE CHEMICALS COMPANY

DIVISION OF UNION CARBIDE CORPORATION

30 E. 42nd Street, New York 17, New York

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For more information circle No. 48 on the Reader Service Card

INVESTMENT CAST 410

continued from page 34

were poured from each heat. One 10# melt was made, from which three flasks were poured. The analysis of the prime, as reported by the supplier, is listed in Table I. Analysis of the three heats, as cast, is given in Table II. After the flasks were knocked out and the test bars cut off, all 44 bars were X-rayed and found to be sound.

For heat treatment, the test bars were packed in neutral compound. They were brought to 1550 F, with the furnace held 6 hours at this temperature, then cooled in the furnace to room temperature. The bars were then machined to standard ¼" diameter design, after which they were hardened at 1825 F in neutral salt bath and oil quenched. All bars were tempered for 3 hours at the temperatures indicated in Table III.

The test bars were pulled on a Tinius-Olsen hydraulic type tensile testing machine equipped with Twist-O-Test holders mounted on spherically seated bars. Yield strength was obtained by the divider method at approximately 0.5% offset. Results of the tests are tabulated in Table III, and are charted in Figure 1.

The results indicate that investment cast 410 stainless steel is capable of meeting the required mechanical properties of most specifications, providing the material is sound and has been properly heat treated. This has added significance when it is noted that the cast material has no directional properties. The results will be the same if the force is applied in any direction on the casting.

For further investigation, we believe that varying the time at each of the tempering temperatures should provide us with valuable information. Also, homogenizing the test bars at 2100 F before any further heat treating is done might improve the mechanical properties to some extent.

This is a condensed report of a research project carried out by Precision Metalsmiths, Inc., for the Investment Casting Institute. It is another in a series of these reports being published in PRECISION METAL MOLDING.

High-Temp, High-Strength Die Casting Alloy

Designers looking for a high-temperature, high-strength light weight alloy may have their answer in a new alloy developed by the Dow Chemical Co.

The new alloy is a member of the magnesium-thorium group and contains approximately 1% thorium, 1% manganese, and the balance magnesium. It has been designated HM11XA. Besides being the first die-casting alloy, in any metal, for service above 500°F, HM11XA weighs only 0.064 lbs. per cu. in.

The room and elevated temperature properties as determined by separately cast ASTM, ¼" diameter, test bars are given in Table I and Figure 1. Other properties of interest to designers and producers are:

Damping Capacity – Superior to conventional aluminum base and magnesium base die casting alloys.

Thermal Conductivity – Comparable to conventional aluminum base die casting alloys and superior to magnesium base alloy AZ91.

Ductility – About the same as AZ91, at room temperature.

Modulus of Elasticity – Higher, at elevated temperatures, than AZ91.

Finishability – All conventional finishes can be used. This includes electroless nickel and HAE processes.

Cost – Higher than AZ91 due to the relatively high thorium content and more exacting melt-preparation requirements.

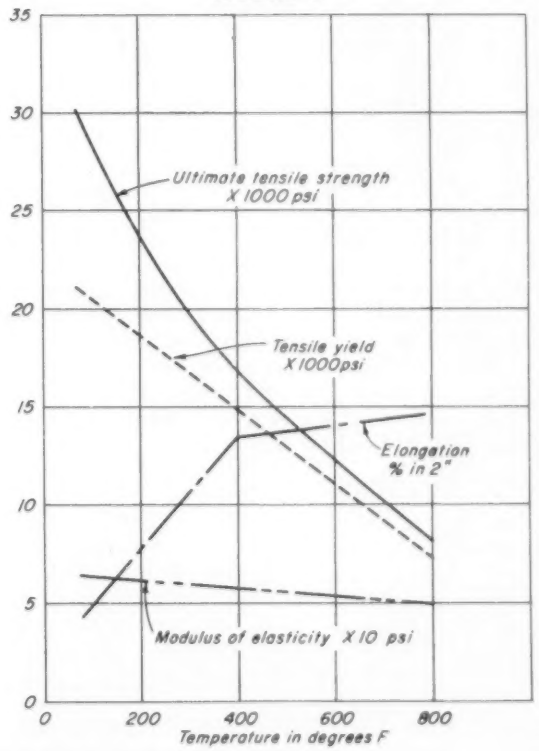
The new alloy can be die cast in conventional machines and dies with a minimum of die revisions. As with AZ91, rapid metal injection rates are necessary, especially with thin-section, large-area castings. Metal preparation is more exacting than for conventional alloys and analytical facilities are required to assure correct composition.

MECHANICAL PROPERTIES OF HM 11 XA*

TABLE I

70 degrees F test temperature	Average Value
Tensile strength (psi)	30,200
Tensile yield strength (psi)	21,200
Elongation (% in 2")	4.3
Modulus of elasticity (psi)	6,500,000
400 degrees F test temperature	
Tensile strength (psi)	16,800
Tensile yield strength (psi)	14,600
Elongation (% in 2")	13.5
Modulus of elasticity (psi)	5,900,000
600 degrees F test temperature	
Tensile strength (psi)	12,400
Tensile yield strength (psi)	11,100
Elongation (% in 2")	13.6
Modulus of elasticity (psi)	5,600,000
800 degrees F test temperature	
Tensile strength (psi)	7,800
Tensile yield strength (psi)	7,300
Elongation (% in 2")	14.7
Modulus of elasticity (psi)	5,000,000

FIGURE 1



*Values determined on separately cast, ¼", ASTM test bars

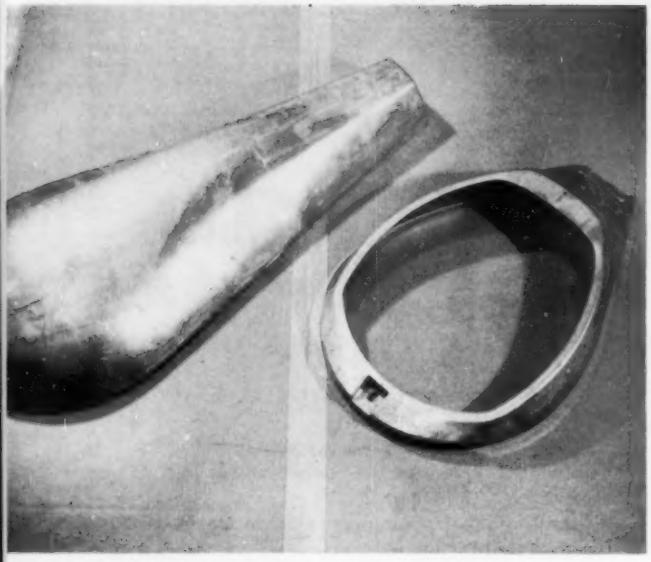


FIGURE 1. Two castings used in street lighting fixtures. The larger casting is a housing, and is almost 40 in. long.

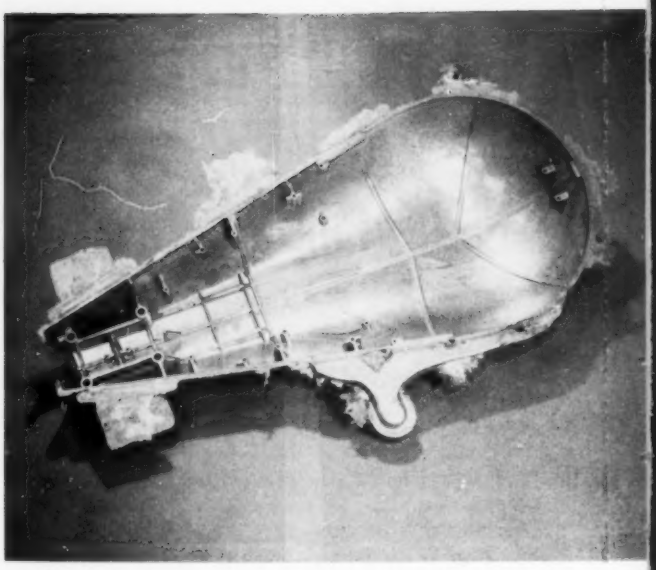


FIGURE 2. Underside of housing casting shows stiffening ribs, mounting bosses, holes, and support members cast in.

For parts on street lighting fixtures, here's . . .

How Westinghouse Uses Die Castings

WHY DOES Westinghouse Electric Corp. die cast the housing and lens ring for some lines of street lighting fixtures? Better appearance and lighter weight are the principal reasons and slightly lower cost a final reason.

The housing casting is big. Almost 40 inches long and about 24 inches wide at its widest point. It takes a 12 lb. 5 oz. shot and after trimming the casting weighs 8 lbs. 11 oz. To hold the weight down, the casting has to have very thin walls and these have to be held to 0.090". With a casting of this size, such thin walls have to be stiffened and besides, there's quite a bit of mechanism to mount inside. The design combines stiffening ribs with mounting bosses and support areas so that maximum use of all of the metal cast can be made.

HOW THEY'RE MADE

The housing castings are made on a 1000 ton locking pressure Cast-Master machine set to cycle at from 25 to 30 shots per hour. With such a heavy shot, hand ladling is not feasible so a two chamber Lindberg-Fisher breakdown and holding furnace is used that is equipped with a Lindberg Autoladle. This furnace has a capacity of 2300 lbs. of aluminum and can handle trim scrap as well as ingot metal on the breakdown side. Heating is by induction using 60 cycle power. Generally, however, it is not desirable to charge trim scrap into this furnace and a separate gas fired Eclipse breakdown furnace with a 1000 lb. bowl is used. Metal from this furnace is hot transferred to the induction furnace.

Because these castings are quite large, relatively complex and because good surface is very important the die is carefully cleaned between each shot and then lubricated. While this slows the cycle of casting somewhat, the number of rejected castings is so sharply cut that the overall production is greater.

As the illustrations show, the reflector rings are somewhat smaller than the housing. These castings are made on a 600 ton Cast-Master machine. The same care is exercised in making these parts as in the larger ones. In this case also, a Lindberg Autoladle is used for feeding the die casting machine.

Trimming is done on Cast-Master trim presses. One press is set up by each casting machine. The trim dies are designed to trim and straighten, if necessary, in a single operation. While close trimming is done on these parts, there is still a slight rough edge. Thus far, the most economical method found for smoothing this edge is with a hand file.

LITTLE MACHINING NEEDED

As the illustrations show, all of the mounting members needed in assembly are cast in. Practically all holes are cored. Final machining is, therefore, very simple. An 11 spindle automatic tapping machine is used. Two holes are tapped on a single spindle ma-

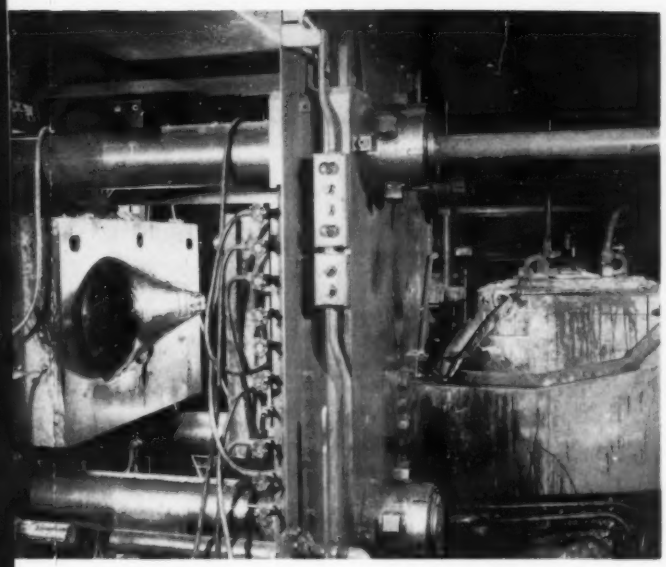


FIGURE 3. Ejector half of housing die on 100-ton die casting machine; Autoladler is shown in right background.

chine and the automatics do all of the rest. Assembly, as shown, is on a continuous line. The final outside finish is a sprayed coat of aluminum paint to give a completely uniform appearance.

The accompanying photos give the step-by-step manufacture of these lighting fixtures.

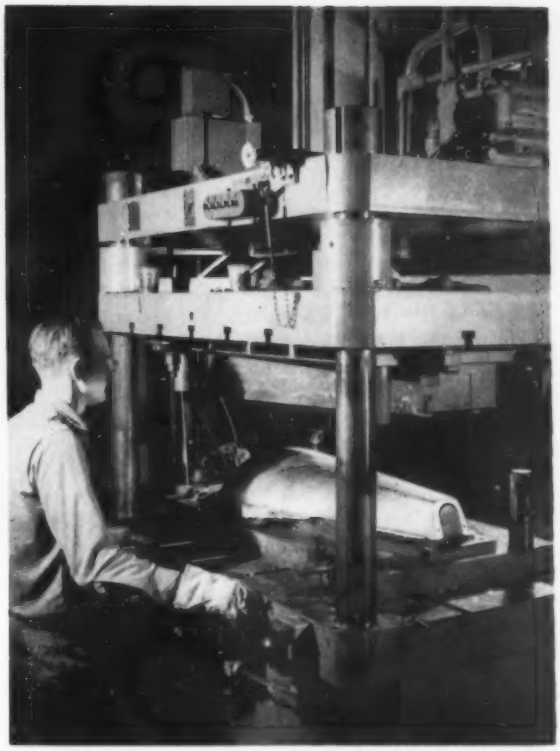


FIGURE 4. Housing is trimmed on a Cast-Master trim press, This unit features fast approach and slower cutting speed.

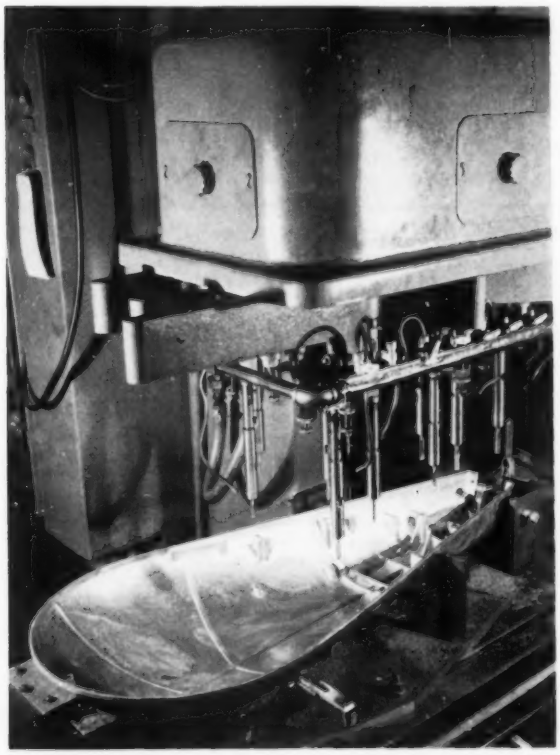


FIGURE 5. Machining is easy, with almost all of it done on this 11-spindle automatic tapping machine in one step.

FIGURE 6. Final assembly consists mostly of positioning and fastening components; the surfaces are spray painted.

Investment Casting Institute Standards

Part II: Visual; Penetrant and Magnetic Particle Inspection

VISUAL STANDARD

Inspection

1. Inspection of cast, or cast and machined, surfaces for adherence to visual acceptance standards shall be by the naked eye in sunlight or normal white light without benefit of magnification unless otherwise agreed to between customer and supplier. In no case, however, will visual acceptance be performed under more than five magnifications. Treatments such as acid etching to remove surface metal prior to inspection will not be done unless agreed upon.

2. Acceptance for visual standards will be based upon surface appearance only, exclusive of RMS or RHR values, and without consideration of magnetic particle, fluorescent penetrant, radiographic or other non-destructive testing requirements or findings.

3. Acceptable positive surface irregularities, as noted below, must fall within the tolerance range of the surfaces involved unless otherwise agreed to between customer and supplier. Acceptable negative surface irregularities will not be used as reference for dimensional measurements of the surfaces involved.

Classification of Irregularities

1. Positive surface irregularities on castings may be as a result of excess metal caused by metal penetration into the ceramic material, or by air or liquid entrapment next to the pattern during investing.

2. Negative surface irregularities on castings may be caused by slag or oxide inclusions, gas, shrinkage, oxidation pitting or cracks.

3. Positive surface defects, generally referred to as excess metal, are not potential stress raisers, and so acceptance evaluation is usually based upon esthetic values provided tolerance requirements have been met. Negative surface irregularities may be both propagating or non-propagating in degree. Propagating indications would be visual surface cracks or cold shuts, while non-propagating would be oxidation pitting, oxide or slag inclusions, or shallow linear depressions.

Standards

1. Evaluation: The evaluation of visual standards is recognized to be an area subject to differences in opinion because of almost complete dependence upon human judgement. As such, extremely close co-operation and understanding of mutual problems between customer and supplier is necessary. Standards should be based upon the widest acceptability possible, as noted in Table I.

2. Requirements: Acceptability requirements for individual areas should be based upon Table I; however, other degrees of severity may be substituted if agreed upon between customer and supplier.

3. It is strongly urged that the customer furnish blueprints specifying areas by class.

TABLE I

VISUAL STANDARDS

All Values Listed Are Maximum

DESCRIPTION	CLASS I	CLASS II	CLASS III	CLASS IV	CLASS V
Propagating Imperfection					
Cracks Cold Shuts	None Allowed	None Allowed	None Allowed	None Allowed	None Allowed
Non-propagating Imperfections					
All Pits	None Allowed	.015 Dia. x .015 deep. Four per square inch. No closer than 1/4" apart.	.015 Dia. x .015 deep. Six per square inch. No closer than 1/8" apart.	.031 Dia. x .031 deep. Six per square inch.	.062 Dia. x .062 deep. Six per square inch.
Oxidation Pitting	None Allowed	.005 Dia. x .005 deep. No other limitations.	.010 Dia. x .005 deep. No other limitations.	.015 Dia. x .010 deep. No other limitations.	.031 Dia. x .015 deep. No other limitations.
Linear Depressions	None Allowed	.010 deep x .010 wide x 1/2" long. One per square inch.	.010 deep x .010 wide x 1" long. One per square inch.	.015 deep x .015 wide x 1" long. One per square inch.	.031 deep x .031 wide x 1" long. One per square inch.
Excess Metal					
Gross	None Allowed	.125 Dia. x .010 high. One per square inch.	.125 Dia. x .010 high. Two per square inch.	.250 Dia. x .010 high. Three per square inch.	.016 high. No other limitations.
Fine	None Allowed	.010 Dia. x .010 high. Three per square inch.	.010 Dia. x .010 high. Eight per square inch.	.010 Dia. x .032 high. Fifteen per square inch.	.010 Dia. x .032 high. No other limitations.

PENETRANT AND MAGNETIC PARTICLE INSPECTION

Scope

This specification covers the procedure recommended for inspection and classification of castings by penetrant and magnetic particle inspection methods.

Methods of Inspection

Methods of inspection covered by this specification are of the following types:

1. Penetrant methods
   a. Fluorescent (i.e. Zyglo)
   b. Non-fluorescent (die check)
2. Magnetic particle inspection
   a. Fluorescent (i.e. Magnaglo)
   b. Non-fluorescent (i.e. Magnaflux)

Evaluation of Indications

1. Irrelevant indications:
   a. The surface of the casting must be clean, dry, and free from foreign materials prior to inspection by any of the above methods to prevent production of false indications.
   b. Care should be exercised to avoid irrelevant interpretation of indications caused by polar effects due to design factors such as keyways, drilled holes, abrupt changes of section, etc.
   c. Wax flow lines, lubricant lines, and parting lines can, at times, produce false indications.
   d. If there is any doubt as to the validity of an indication, the casting should be inspected by other means or sectioned and examined microscopically.
   e. Indications of themselves shall not be cause for rejection unless so specified by the consumer.
   f. An indication disclosed by a penetrant inspection method that is not visible at 10 power magnification under daylight, shall not constitute a crack.

2. At the time of inspection the nature of the discontinuities shall be determined and placed in one or more of the following categories:
   a. Propagating indications.
   b. Non-propagating indications.
   c. Dispersed indications.

3. Propagating indications are those which could conceivably increase in length or width under stress resulting in failure of the part. In this category would fall cracks, hot tears, segregation, pits or holes so aligned as to be propagating in nature, etc.

4. Non-propagating indications are discrete usually rounded indications. In this category would fall, gas holes, holes resulting from air entrapment, dross holes, inclusions, pits, etc.

5. Dispersed indications are those which are non-propagating in nature but are distributed over a larger area of the casting. In this category would fall sponge and micro-shrinkage (generally found only in aluminum and magnesium castings) gas porosity, etc., where these defects come to the surface.

If a defect can be removed without affecting serviceability, the defect may be removed and the part resubmitted for inspection.

Areas in which welding can be used to correct defects should be so designated on the print by the customer. This will greatly aid in reducing costs and expediting delivery.

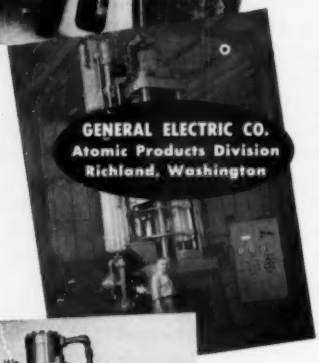
If a defect is completely removed on subsequent machine operations, it cannot constitute a cause for rejection of the part, unless the defect interferes with the machine operation.

Unnecessarily strict acceptance standards always result in increased cost, casting problems, and delivery problems. It cannot be emphasized strongly enough that detailed acceptance standards for each individual casting be provided by the design or engineering departments to the inspection departments of both the consumer and vendor.

The perfect casting has not yet been produced. Therefore, in order to reduce the rejection of good castings, the following table should be used. However, rather than designating an entire casting as Class I or Class II, specific critical areas should be marked on the print as Class I or II and other less critical or non-functional areas should be placed in a lower classification.

NEXT MONTH: Part III, Airfoil Standards.

Type of Imperfection	CLASS I	CLASS II	CLASS III	CLASS IV
Propagating	None Allowed	None Allowed	None Allowed	1 per square inch 1/8" max. length in any direction.
Non-propagating	2 per square inch 1/64" max. length any direction.	4 per square inch 1/64" max. length any direction.	6 per square inch 1/64" max. length or 3 per square in 1/32" max. length.	8 per square inch 1/64" max. length or 4 per square inch 1/32" max. length.
Dispersed	None Allowed	None Allowed	Dia. of area less than 1/4 of smallest surface dim. areas 2" apart min.	Dia. of area less than 1/2 of smallest surface dim. areas 2" apart min.



THESE BLUE CHIP COMPANIES HAVE RECENTLY INSTALLED THE ALL-NEW KUX HYDRAULIC POWDERED METAL COMPACTING PRESSES

because:

- ✓**PUSH BUTTON CONTROL** permits simplicity and flexibility in adjusting fill, pressure, ejection, timing to suit the part being made.
- ✓**BUILT IN BALL BEARING LEADER PIN GUIDE BARS** between both the upper punch holder and the die table, and the lower punch holder and die table provide and maintain perfect tooling accuracy.
- ✓**SECONDARY LOWER PUNCH MECHANISM** for use in pressing and/or ejecting.
- ✓**POSITIVE MECHANICAL PRESSURE STOP MECHANISM** for holding dimensional thickness, or hydraulic pressure control for true density can be utilized.
- ✓**TWO INDEPENDENT FEED SHOES** for producing compacts from two different materials.
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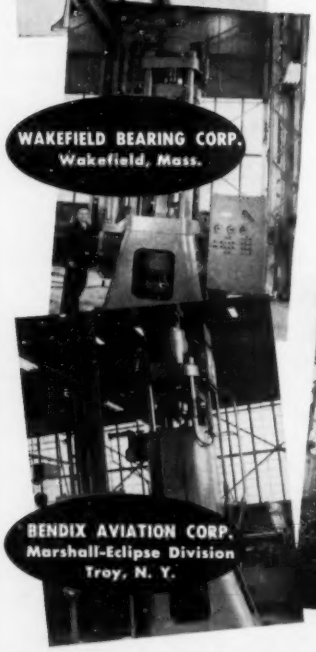

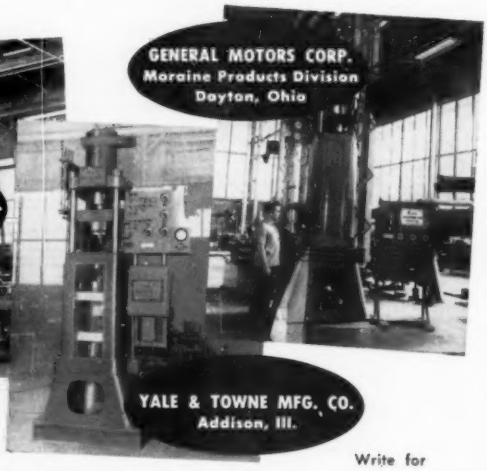

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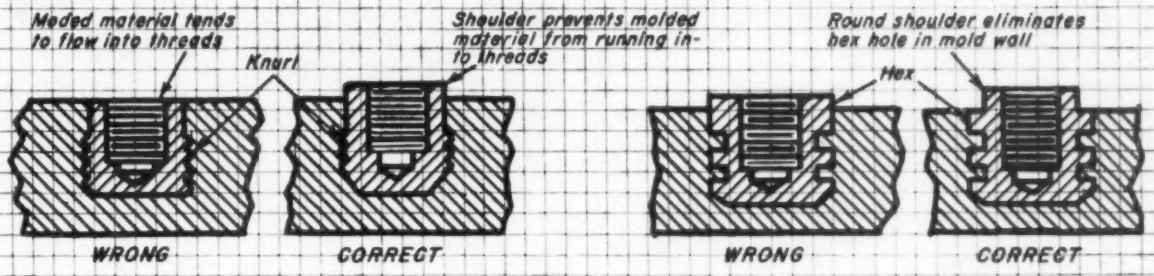

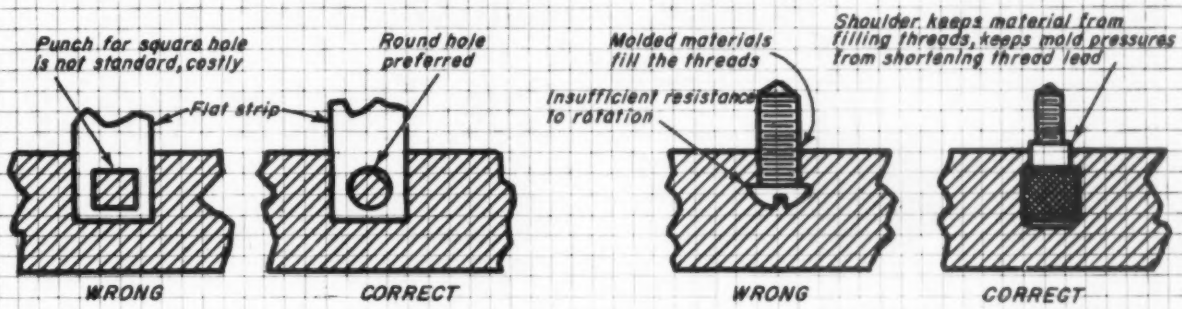

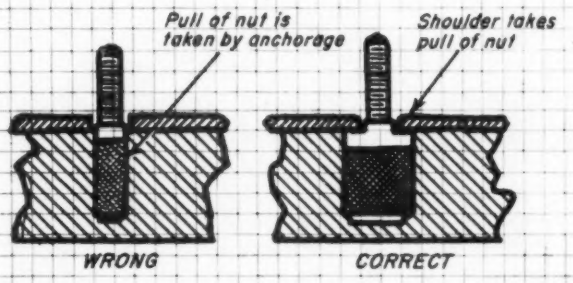

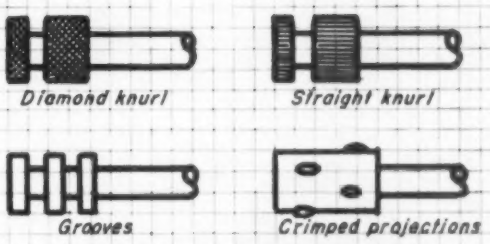

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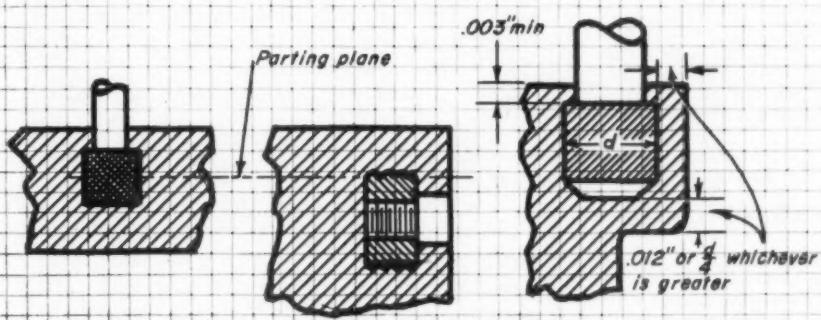

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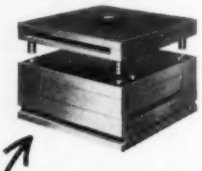

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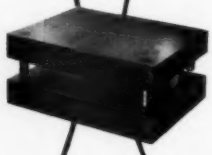

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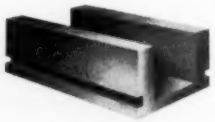

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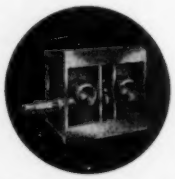

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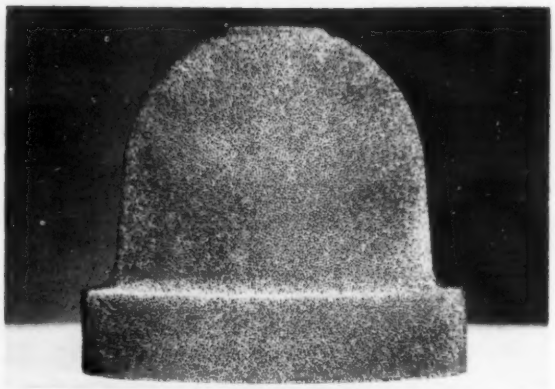

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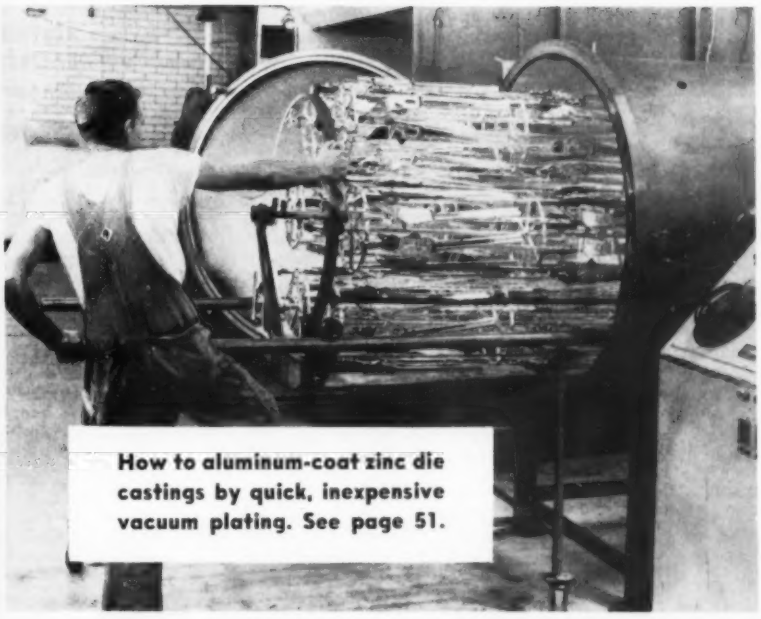
A final important feature of this new vent is that it meets the new code of the National Board of Fire Underwriters.

PMM Finishing Section

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.



How to aluminum-coat zinc die castings by quick, inexpensive vacuum plating. See page 51.

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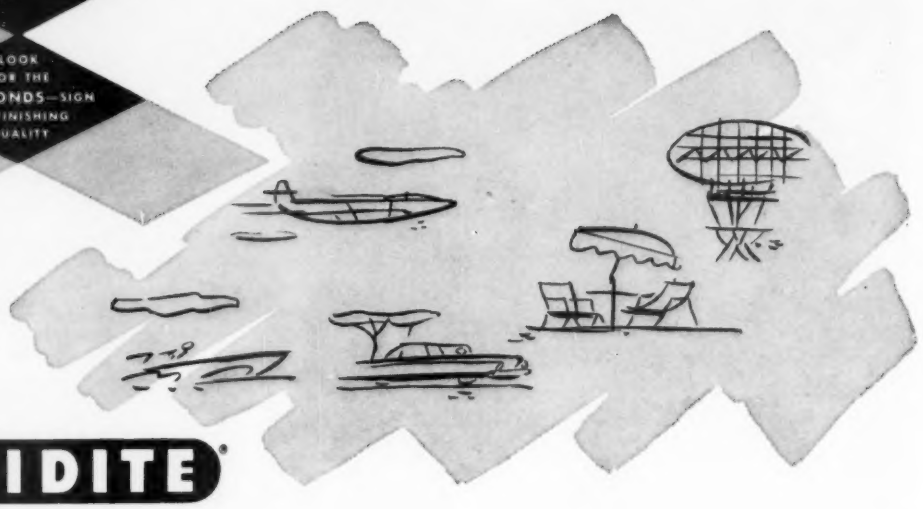

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Improved corrosion resistance with the . . .

Double Plate Method of Chrome Plating

By M. R. CALDWELL*

DOEHLER DOUBLE PLATE is a double layer of nickel of the duplex type that gives superior corrosion resistance to zinc die castings for outdoor exposure. This report summarizes the reasons why it is so highly recommended for exterior automotive hardware.

The life of a copper-nickel-chromium plated die casting is only as good as the copper-nickel plate. A study of plated parts taken from cars exposed to industrial and salt spray atmospheres has proved that a high percentage of the corrosive attack results from penetration of the electro-plated coating from the outside. This means that the corrosive material must travel first through the cracks or pores in the chromium plate and then penetrate through the nickel and copper to reach the zinc base. The primary function of the chromium layer has always been to resist tarnishing. Because the normal chromium layer is always deposited full of cracks, it does not add to the corrosion resistance of the plate.

To improve the copper-nickel-chromium plate, three methods can be used. One is to improve the nature of the chromium plate by eliminating the cracks and porosity and by increasing the thickness, which is referred to as crack-free chromium. A second approach, which is expensive and not always effective, is to increase the thickness of the nickel plate. Even with heavier deposits of bright nickel early failures have been found. A third approach, which our tests have proved to be the best one, is to use a double plate of nickel.

WHY DOUBLE PLATE

We prefer to call this the Doehler Double Plate, as the Doehler-Jarvis Division has pioneered in its use for plating zinc base die castings for parts that require improved corrosion resistance. For more than four years comprehensive corrosion tests of many kinds have been run, with the conclusion that the Doehler Double Plate is the soundest, most logical and most economical approach for improving corrosion resistance. The tests which have been run have included all the duplex nickels on the market, as well as the heavy crack-free chromium.

Co-operative research work was conducted with automotive concerns and it was found that the Doehler Double nickel plate improves the corrosion resistance 25 to 33%, as determined by the American Society for Testing Materials rating system.

In August, 1957, the Doehler-Jarvis Division installed the Doehler Double Plating system in a large copper-nickel-chromium automatic plating machine. Parts on 1958 model cars which were plated with Doehler Double Plate were found to be far superior to other processes. The results have been so successful that the Doehler-Jarvis Division now feels certain that it is a forward step in the development of a more corrosion resistant electro-plate and has, therefore, decided to use the Doehler Double Plate on automotive exterior parts. No difficulty is being encountered in meeting the new accelerated corrosion tests which the automotive companies now specify. It has been found that in some recessed areas on complicated parts, where thickness is somewhat below the minimum specified, the accelerated corrosion tests are easily passed, whether they are Corrodekote or accelerated acetic acid salt spray. It is expected that these recessed areas will give better corrosion performance in the field when plated with Doehler Double Plate than with normal bright nickels.

As would be expected, it was necessary to adjust the process to our specific operating conditions in order to maintain the required brightness and adhesion. The first coat is semi-bright and the top coat full bright, so as to develop the decorative finish. The semi-bright coating, which represents from 60 to 75% of the total thickness, is made from a sulphur-free bath. This means the brightener does not contain sulphur-bearing organic compounds. With this type of semi-bright nickel, the corrosive materials do not penetrate or corrode through as fast, and the overall life is increased from 25 to 33%. Figure 1 demonstrates this. The top layer is the chromium and the bright nickel. The corrosive attack is slowed so much by the

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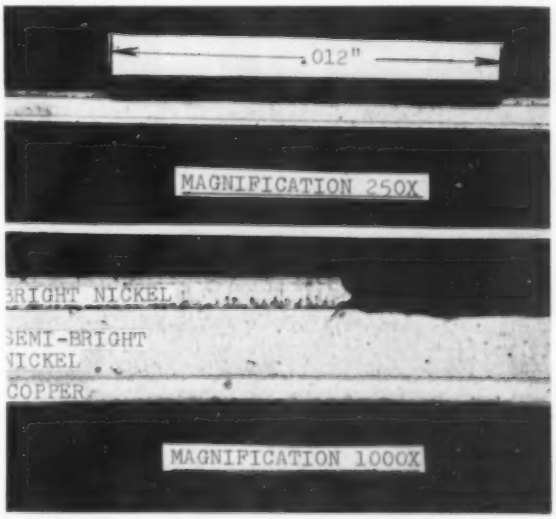

FIGURE 1. Corrosion through chromium and bright nickel.

*MANAGER ELECTROPLATING AND FINISHES DOEHLER-JARVIS DIVISION

semi-bright layer that the corrosion process is forced to spread laterally instead of proceeding vertically through the deposit to the base metal. When no sulphur-bearing brighteners are used, the semi-bright nickel has a different grain structure entirely.

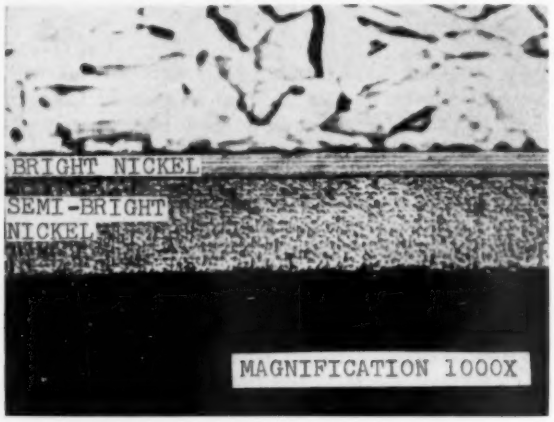

FIGURE 2. Structures of bright and semi-bright nickel.

Figure 2 shows the banded or laminated structure of the nickel observed in the bright nickel section. The semi-bright nickel has a columnar structure which is similar to that of Watts nickel and, because of its nature, it is more resistant to corrosion.

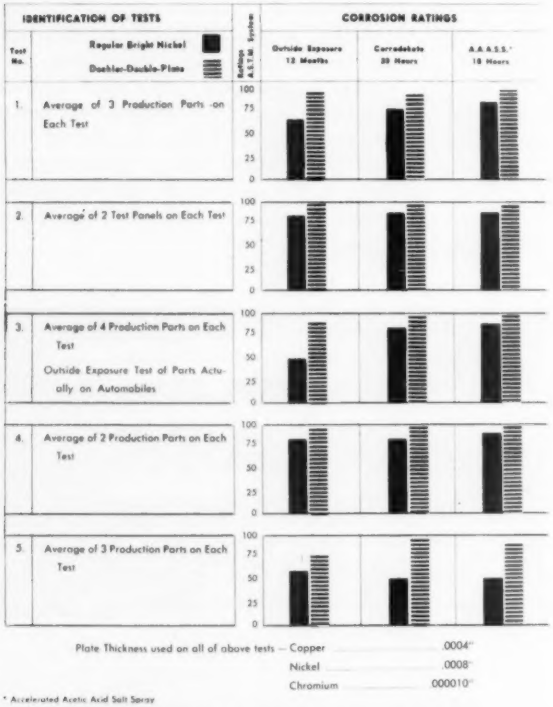
IDENTIFICATION OF TESTS
Test No.
Regular Bright Nickel
Doehler-Double-Plate
CORROSION RATINGS
Rating A.S.T.M. System
Outside Exposure 12 Months
Corrodekote 20 Hours
A.A.A.S.S.* 16 Hours
1. Average of 3 Production Parts on Each Test
2. Average of 2 Test Panels on Each Test
3. Average of 4 Production Parts on Each Test
Outside Exposure Test of Parts Actually on Automobiles
4. Average of 2 Production Parts on Each Test
5. Average of 3 Production Parts on Each Test
100
75
50
25
0
Plate Thickness used on all of above tests — Copper .0004"
Nickel .0008"
Chromium .000010"
* Accelerated Acetic Acid Salt Spray

FIGURE 3. Results of five different corrosion tests.

The bar chart (Figure 3) compares the results of five different corrosion tests that have been completed in the last few years. In every case, the Doehler Double Plate is 25 to 33% better than the regular bright nickel. Many such accelerated corrosion tests have been completed, using both Corrodekote and accelerated acetic acid. It is recognized that there are many variables in such corrosion tests, but Figure 4 shows the difference in the amount of corrosion when a part plated with Doehler Double Plate is compared with the regular bright nickel, both of which are tested by the copper acetic acid salt spray for 20 hours. The part is a

FIGURE 4. At top, regular nickel; bottom, double plate.

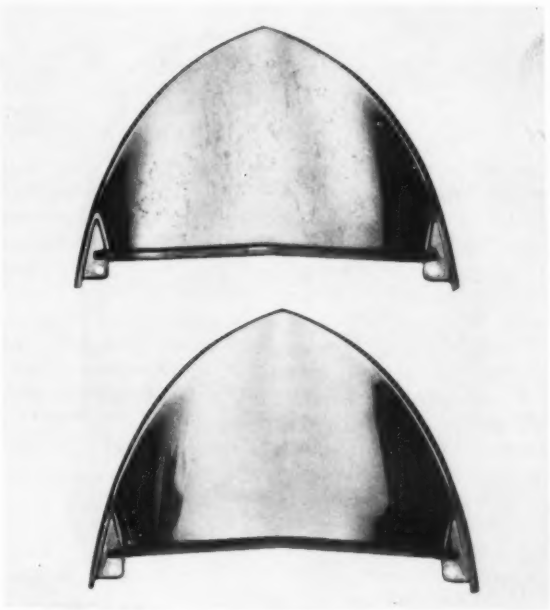

FIGURE 5. Regular plate, top; double plate at bottom.

concaved shaped part which is about 6 inches across. The superiority of the Doehler Double Plate is obvious in that there are only a few pin point corrosion spots down to the semi-bright nickel. Figure 5 shows the amount of corrosion obtained when the same parts as shown in Figure 4 are subjected to 20 hours in the Corrodekote test. The Doehler Double Plate again is far superior in corrosion protection.

An interesting series of corrosion tests was run by an automotive company in Detroit using Doehler Double Plate parts in comparison to two standard bright nickel plates. These were exposed in five different corrosion tests:

1. Acetic acid salt spray, 8 days.
2. Neutral salt spray, 8 days.
3. Copper-accelerated acetic acid salt spray, 16 hours.
4. Copper-accelerated acetic acid salt spray, 48 hours.
5. Detroit Laboratory roof, 34 days.

Figures 6, 7, and 8 illustrate the results of these tests. The conclusions drawn are:

- The Doehler Double Plate stood up perfectly for 34 days on the roof without any corrosion spots. Both bright nickel #1 and #2 showed many corrosion spots through to the base metal.
- Similar parts which were tested for 8 days in acetic acid salt spray showed the Doehler Double Plate to be more corrosion resistant than the two bright nickels.
- The 16-hour and 48-hour tests with the copper-accelerated acetic acid salt spray produced the same results as similar parts exposed outdoors. Where the Doehler Double Plate stood up perfectly, the two bright nickel plates showed many spots through to the base metal.
- When tested for 8 days in the neutral salt spray, all three plates looked very bad. This reflects the inaccuracy of the regular salt spray test which corrosion experts are condemning for its inability to duplicate normal corrosion conditions.

A similar group of parts was tested in the Doehler-Jarvis laboratory with the 20-hour Corrodekote test with results that confirmed the outdoor test and the copper accelerated acetic acid salt spray test in that it showed the same differences in behavior between the Doehler Double Plate and two regular bright nickels.

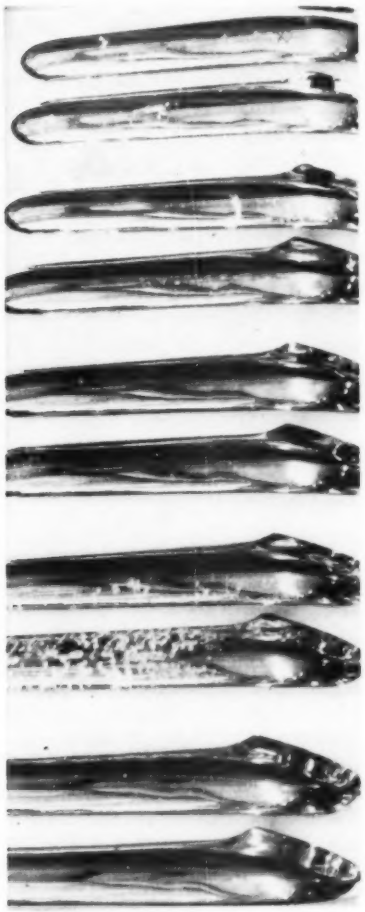

FIGURE 6. Bright nickel #1.

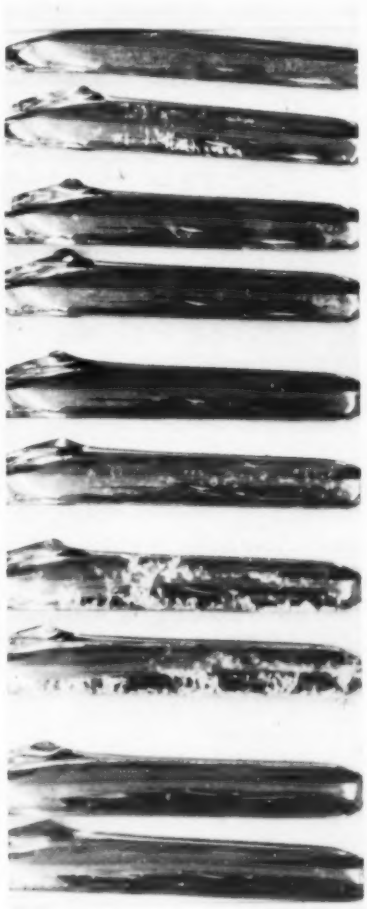

FIGURE 7. Bright nickel #2.

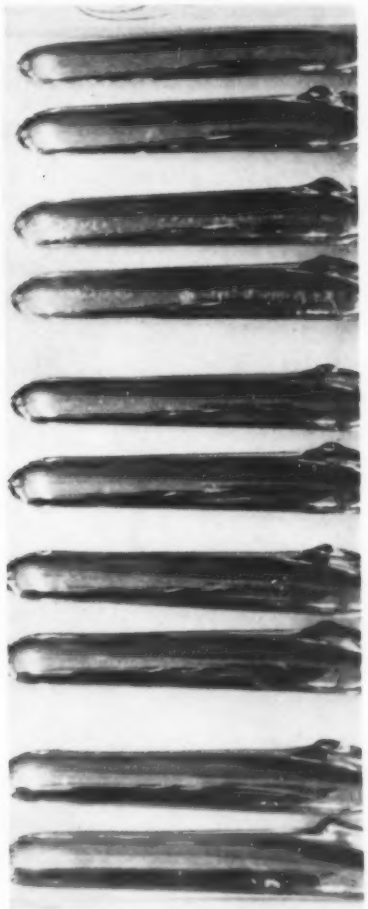

FIGURE 8. Doehler Double Plate.

NOTE: In Figures 6, 7, and 8, the top two parts in each photo were exposed to Test 1 (acetic acid salt spray, 8 days) of Tests 1 through 5 described above. The next two parts were exposed to Test 2, and so on through Test 5.

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FINISHING ABSTRACTS

Editor's note: The following abstracts from *Metal Finishing Abstracts* published bimonthly by Robert Draper, Ltd., Teddington, Middx., England, should be of particular interest to readers of PRECISION METAL MOLDING. Subscription to Metal Finishing Abstracts is $15.00 per year ($20.00 by air mail), six issues per year.

Precision Barrelling. Automobile Eng., 1958, 48, No. 13, 536-540.

A review of barrel finishing techniques at Rolls Royce, Ltd. The effect of barrelling, using various load heights and treatment times, on the radius is given for brass, copper, nickel, and stainless steel. Short-life coarse grain in combination with long-life fine grain, lubricants, inhibitors and brighteners are used in the form of tablets, which are manufactured in seven grades.

Electroplating on Aluminum Alloys (Zinc Immersion Treatment). J. Met. Finishing Soc. Japan, 1958,9, No. 10, 361-365.

Zinc immersion treatment of various aluminum alloys was investigated. Optimum conditions for commercial operation were: (a) alkaline solution, suitable for aluminum-silicon and aluminum-copper-silicon alloys, sodium hydroxide 120-525 g/1, zinc oxide 20-100 g/1, temperature 5°-25°C; (b) acid solution, suitable for aluminum-magnesium alloy, zinc sulphate 500-750 g/1, 48% (vol.) hydrofluoric acid 0.5-1.5 cc/1, temperature 10°-25°C.

Surface Treatment of Zinc Base Die Castings. G. Galli, Galvano Tecnica, 1958, 9, No. 12, 301-308.

The influence of surface properties of castings is discussed. The recommended sequence comprises: polishing – trichlorethylene degreasing – alkaline cleaning – cathodic cleaning (50°C, 20-30 amp./sq. ft., 5-10 sec.), rinse, 3% (wt) sulfuric acid dip, rinse, copper plate to 0.2 mil in a cyanide bath with or without P.R., or in a pyrophosphate or ethylenediamine bath or bronze plate, rinse, dip in 5-10% hydrochloric acid, rinse and bright nickel plate. Operating conditions and porosity testing are discussed.

ONE OPERATOR sets controls for plating batch of castings (right); second operator unloads another chamber (left).

Aluminum coat quickly and inexpensively by . . .

Vacuum Plating Zinc Die Castings

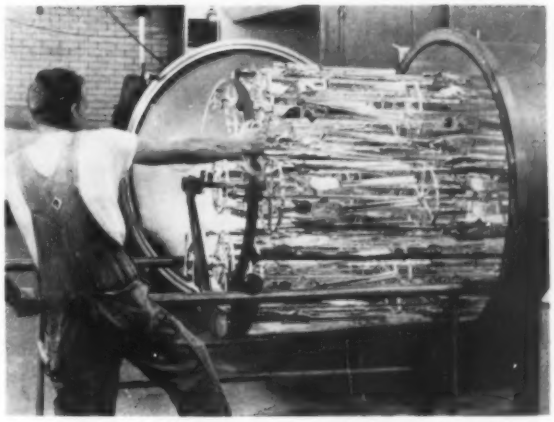
THE FASTEST toy gun in the West is now being made by Nichols Industries, Inc., Jacksonville, Tex. By switching from electroplating to vacuum metallizing, Nichols can now aluminum-coat its guns quick as a flash, at a fraction of the time and expense it used to cost. And the new finish is a lot brighter too.

The gun parts—most of them zinc die castings—are placed on racks and coated with lacquer. When the lacquer dries, the racks are loaded on the revolving spiders of a metallizing reel. The reel is then rolled into the chamber of a 48-in. Stokes vacuum plater by means of a portable loading dolly. Arranged axially in the chamber is a series of tungsten filaments on which are hung U-shaped pieces of pure aluminum wire.

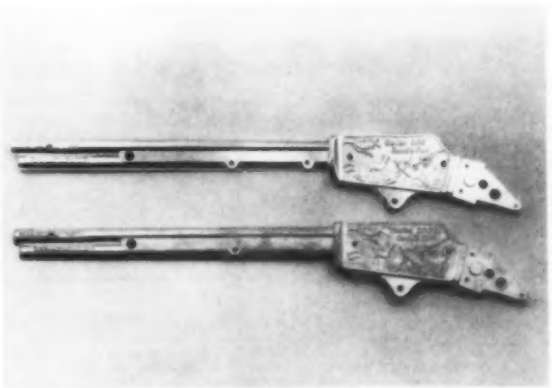
The door of the plater is sealed and the chamber is evacuated to a pressure of 0.5 microns. This takes about four minutes. During evacuation, electricity is sent through the filaments, heating them just enough to melt the aluminum and cause it to flow over the filaments. When the desired pressure is reached, full power goes into the filaments, bringing them to incandescence and vaporizing the aluminum. The vaporized aluminum flashes off in all directions, coating everything in its path in a matter of seconds. The spiders are rotated during flash-off, with the result that all exposed surfaces get a uniform coating of aluminum about one molecule thick.

The racks are then removed from the chamber and the parts get a top coat of lacquer to protect the aluminum. When this sealing coat is dry, the parts are ready for assembly.

Nichols started using the vacuum plating technique with one Stokes unit, now has a battery of four working around the clock, five days a week. It takes two men per shift to operate the battery.

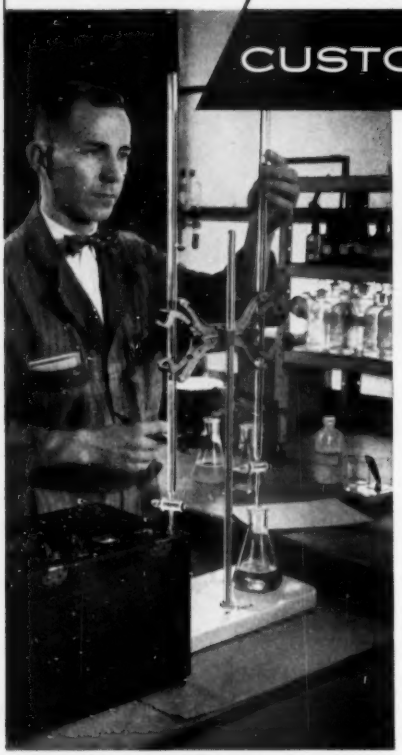


METALLIZED REEL of parts is rolled onto portable dolly.



PLATED PART is shown on top; below it is unplated one.

consult the.... Roto-Finish CUSTOMER'S MAN



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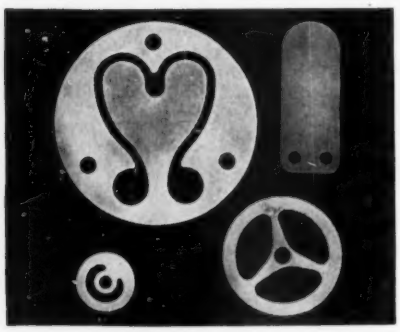
Faced with the problem of cutting down finishing costs with no sacrifice in product quality, more and more production and management men are turning to Roto-Finish for complete finishing *service*.

In the Roto-Finish Laboratory, technicians analyze your problem to determine the process which provides the desired finish at minimum cost. Often, it is necessary *to develop a new compound* to meet a specific need.

Test runs are then made in the Roto-Finish Processing Department under production conditions. If desired, your local Roto-Finish Customer's Man will run these tests in your own plant; so that you can check the results at first hand, results like this...



Roto-Finish CASE HISTORY

PART: Refrigeration compressor flapper valves. • MATERIAL: Swedish steel. OPERATIONS PERFORMED: Deburr. Generate full radii on all edges. Remove stress risers. • RESULT: Fatigue resistance increased 500%.

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Roto-Finish COMPANY

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MOLYBDENUM DIES

continued from page 32

tered molybdenum may well be the answer to some of the materials problems which have always confronted die casters of brass and higher melting point alloys. Molybdenum's excellent resistance to heat checking, its good machineability, high melting point, high temperature strength, high thermal conductivity, and low thermal expansion make it attractive as a material for die products, cores and machine parts.

Present plans at General Electric are to intensify the field applications work and, if initial promise is sustained, the company hopes to have a commercial product available later this year. At the present time, cost comparisons with available hot-work tool steels are not available.

ADCI RESEARCH REPORT

About 1953, the Die Casting Research Foundation, the research arm of ADCI, commissioned Battelle Memorial Institute to conduct an investigation to improve the service life of die casting dies. Of the hundreds of materials screened and tested, only molybdenum showed substantial improvement in resisting heat checking. Table I shows the comparative properties of three materials investigated.

Early work with molybdenum showed that the material was extremely brittle in the transverse direction, resulting in gross cracking in the direction of working. Elongation varied from 2 to 20 percent in the same piece. Poor mechanical properties at room temperature, lack of a wide range of sizes, and high cost were early deterrents.

Work with the Climax Molybdenum Corp. of Michigan and the Universal-Cyclops Steel Co. resulted in greatly improved material, particularly as to room temperature properties and transverse cracking.

Materials produced by the best techniques so far developed were production tested by several DCRF member companies as cores in dies producing zinc, aluminum and magnesium castings. Substantial

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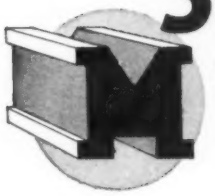
improvement, as compared with steel cores, was reported by 68%. Only 18% reported no improvement and 14% of the cores are still on test.

The advantages reported for molybdenum cores are: decreased downtime for polishing, longer life before heat checking and replacement, and lower scrap from tears on the casting surface. The disadvantages reported are: lack of mechanical strength and ductility, low hardness and abrasion resistance, sensitivity to thermal shock at lower temperatures, and high price.

DCRF results showing low hardness and room temperature strength have retarded the use of molybdenum for die blocks. Lack of large sizes is also a deterrent factor. (By using sintered blocks of molybdenum the size factor is far less a factor. – ed.).

Battelle research has not been encouraging when molybdenum die or core material is used for brass die casting. Premature pitting and gross cracking have been the major points of failure.

You can benefit by Milwaukee's 50 Years' Service to Industry

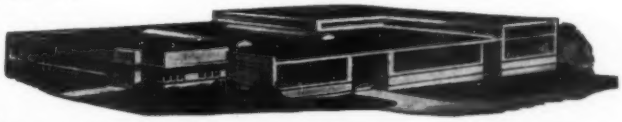


50th ANNIVERSARY 1909-1959

Since 1909, it has been the privilege of the Milwaukee Die Casting Company to work with manufacturers of a wide variety of products ... from mechanical pencils to airplanes ... in applying the die casting process to their problems of parts design and production. In those 50 years, Milwaukee has pioneered many of the developments which have since become standard practice.

If you wish to benefit by our 50 years of continuous service to industry coupled with the advantages of our modern die casting plant, we invite your inquiries.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.



MILWAUKEE DIE CASTING COMPANY

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USEFUL LITERATURE, CATALOGS, MANUALS

any of these technical publications may be obtained by circling the numbers on the Reader Service Cards facing Page 68

PROCESSES

153 Die Castings — BROWN-LIPE-CHAPIN DIV., GENERAL MOTORS CORP. — Report on the company's facilities for precision die casting and specialized finishing. Includes technical data on the plant's equipment.

154 Plaster Mold Castings—UNIVERSAL CASTING CORP.—3 technical brochures on vacuum cast precision castings.

155 Die Castings—DOEHLER-JARVIS—Engineering data on the process. Includes tabular listing of the most specified alloys for die castings.

156 Permanent Mold Castings — BENDIX FOUNDRIES — Report on the company's facilities for die casting, shell mold casting, plaster mold and permanent mold castings.

157 Die Castings—HAMPDEN BRASS & ALUMINUM CO.—Technical report on die and permanent mold castings.

158 Precision Castings—FABRICAST DIV., GENERAL MOTORS—Engineering data on die casting, permanent and semi-permanent mold, investment casting and sand casting.

159 Investment Castings—RAUSCH MFG. CO., INC.—Technical report on the investment cast process, step-by-step.

160 Shell Mold Castings—AMERICAN STEEL FOUNDRIES—Technical brochure on steel shell mold castings. Lists tolerances attainable.

MATERIALS & EQUIPMENT

161 Silicone Products—GENERAL ELECTRIC CO.—8-page technical report on silicone products and their uses.

162 Furnaces—C. I. HAYES, INC.—Technical report on Type BA and BA-M pusher furnaces for temperatures to 2600 F.

163 Cadmium Products — WHITE METAL ROLLING & STAMPING CORP.—Engineering report gives detailed analysis of cadmium. Includes information on the rolling and extrusion of mill products.

164 Working Magnesium — DOW CHEMICAL CO.—28-page technical report on the recommended practices for working magnesium alloys of the thorium and rare-earth-metal families.

165 Determination of Carbon—APPLIED RESEARCH LABORATORIES, INC.—Research report on the determination of carbon, sulfur, etc., in alloy steel by using a vacuum spectrometer.

166 Zirconium-Copper Alloy — AMERICAN METAL CLIMAX, INC. — Engineering report on this new alloy that has excellent electrical conductivity and high-temperature strength properties.

167 Chromallizing—CHROMALLOY CORP.—4-page technical report on the process for diffusing chromium into the surface of metal parts. Includes application data.

168 Rivet Standards—TUBULAR & SPLIT RIVET COUNCIL—The dimensional standards of semi-tubular rivets.

169 Bonding Carbide — POWDER ALLOYS CORP.—Technical report on a new process for joining cemented carbide to steel.

170 Brazing—HANDY & HARMON—Application data on hand torch brazing.

171 Air Motor — HANNIFIN CO.—8-page technical bulletin gives specifications and dimensions on the company's air motor line.

FINISHING

172 Fixtured Deburring — MECHA-FINISH CORP. — 12-page engineering report on the Mechamatic Process for fixtured deburring and finishing.

173 Polishing Brushes — ENGIS EQUIPMENT CO.—Technical literature on a new line of brushes for all final polishing operations on dies, molds and gages.

174 Low-Temperature Cleaning—OAKITE PRODUCTS, INC. — Technical literature on the savings made possible by cleaning metals with room temperature cleaners.

175 Gold Dye—ALLIED RESEARCH PRODUCTS, INC.—Technical data on a new gold dye for use over a clear, Iridite film.

176 Drilling, Tapping Units — HYPNEUMAT INC. — A series of technical bulletins on automatic drilling and tapping units that are air or hydraulic powered.

177 Heavy-Duty Barrels—PANGBORN CORP.—16-page engineering report on heavy-duty barrels specially designed for rugged cleaning jobs.

178 Multi-Purpose Compound — ESBEC BARREL FINISHING CORP.—Technical data on a multi-purpose, non-acidic barrel finishing compound.

179 Protective Coating—TURCO PRODUCTS, INC.—Technical literature on a solvent-or-alkali removable coating for in-shop protection of surfaces during storage.

180 Bright Dip—ROSSAUL CO.—Technical literature on Copper-Brite, a safe and passivating bright dip for brass, copper, bronze, nickel silver, phosphor bronze and berilliyum copper.

181 Preassembled Fastener — EATON MFG. CO. — Engineering data on a fastener that combines a spring washer with a hex nut.

182 Flat Polisher — MURRAY-WAY CORP. — Technical data sheets on a Junior Flat Polisher, designed to grind, polish and deburr flat surfaces with cross sections up to 12″ by 4″.

183 Cleaning Guide — MAGNUS CHEMICAL CO. — Chart helps you select the correct cleaning method and chemical for the various metals and soils encountered in metalworking.

192 Buffing Compound — HANSON-VAN WINKLE-MUNNING CO. — 20-page technical bulletin on more than 150 compounds and their application.

193 Trimming Press — SALES SERVICE MFG. CO. — Technical data on a 40-ton press that will handle large or bulky die sets for die cast trimming.

194 Spindle Finishing Machines—ALMCO, QUEEN PRODUCTS DIV. — Technical report on 5 new spindle-type finishing machines for continuous "in-line" production.

195 Tumbling Barrel — S. E. LANDON CO. — Data sheet on a barrel molded of fiberglass with a compounded hexagonal shape. The barrel is lined with a synthetic material.

196 Compound Selector Chart — TECHLINE DIV., WHEELABRATOR CORP. — The chart is designed to speed and simplify the ordering of barrel finishing compounds.

197 Deburring Tool — NOBUR MFG. CO. — Engineering data on a single purpose tool that deburrs 3 different hole sizes.

198 Circular Sawing — DEWALT DIV., AMERICAN MACHINE & FOUNDRY CO. — 18-page engineering manual on high-speed sawing of aluminum alloys.

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DIE CASTING LUBRICANTS

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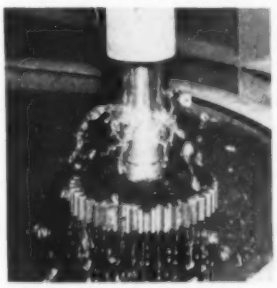
Here's how ALMCO's New Spindle Finishing Process gives precision finishing of complex components...

1 Operator air-chucks part to be finished to spindle after having just released the finished part.

2 Part is lowered into high velocity stream of abrasive media. Spindle rotates while in stream.



3 Index head carries spindle thru tub of abrasive media until it again reaches operator's station. Water rinses media away.

4 Result: fast and even action! In most cases, 0.005 to 0.015-in. radii can be generated on hardened gear teeth in 2-4 mins.

...and on a continuous production line basis!

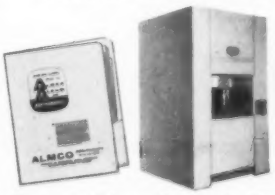
The ALMCO Spindle Finishing Process now makes possible precision finishing of complex, high-quality components such as gears, bearing cages, spline shafts, pump rotors, jet blades, etc. . . .

- *at production rates heretofore not possible . . .*
- *on a continuous production line basis . . .*
- *and with all surfaces receiving the same controlled amount of precision finishing!*

Here's how it works. Large parts or clusters of smaller parts are chucked directly to the spindles from a single operator's work station. Spindles lower the parts into a high velocity stream of abrasive media contained in a tub that rotates at a controlled speed of from 275 to 600 sfpm at the spindle center line. Spindles themselves also rotate at 13 rpm while in the abrasive stream, while the indexing head slowly carries all spindles in a 1 to 9 minute trip around the tub. Operator merely removes and replaces parts on spindle chucks as they appear before him. Models are available with automatic or manual indexing, 2 to 16 spindles, tub diameters of 48" to 90", and drives of from 5 to 30 hp.

For Full Story on ALMCO Spindle Systems and on free processing of sample parts, write for ALMCO Album of New Products!

ANOTHER REPORT FROM THE ALMCO ALBUM OF NEW PRODUCTS



ALMCO
QUEEN PRODUCTS DIVISION
King-Seeley Corporation
77 E. Main Street
Albert Lea, Minnesota

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NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

KAISER INCREASES CAPACITY

KAISER ALUMINUM & CHEMICAL CORP. has put into operation another 22,000 tons of primary aluminum capacity by reactivating a potline at its Mead, Wash., reduction plant. The company is now operating at a total annual level of 524,500 tons, highest in its history. This represents 86% of its total annual capacity.

ICI SEES SALES INCREASE

The INVESTMENT CASTING INSTITUTE, after an industry survey of the business outlook, forecasts a 20% increase of sales for investment castings in 1959. Sales of companies participating in ICI's monthly statistical program already are 24% over 1958, and new orders are considerably over what they were for the previous year. This outlook covers sales both in aircraft and commercial applications.

BRADLEY AGAIN HEADS LEAD INDUSTRIES ASSOC.

John D. Bradley, president of The Bunker Hill Co., was re-elected president and board chairman of the LEAD INDUSTRIES ASSOCIATION at its recent annual meeting. Re-elected vice presidents were: F. S. Mulock, president, United States Smelting Refining and Mining Co.; Felix Edgar Wormser, vice president, St. Joseph Lead Co.; Kenneth W. Green, director of purchases, The Electric Storage Battery Co. Robert L. Ziegfeld continues as secretary-treasurer.

ALUMINUM EXTRUDERS COUNCIL TO VISIT KITIMAT

The ALUMINUM EXTRUDERS COUNCIL, which will meet during the week of August 10 at Vancouver, British Columbia, will make an overnight trip to Aluminium Limited's Kitimat smelters.

Council members will fly 400 miles by chartered plane from Vancouver to Terrace, then take buses to Kitimat. They will first tour the Kitimat smelters, and then, after a five-hour scenic boat trip, will inspect the huge underground hydroelectric power installation at Kemano which serves Kitimat.

After returning to Kitimat, the extruders will take a tour of the Kitimat docks and townsite, then return by plane to Vancouver. Conference headquarters for the Council will be the Hotel Vancouver. A program of sightseeing tours, sports, and side trips is planned for families of attending members.

KITIMAT SMELTER and dock area. It has a capacity of about 180,000 tons a year.

JOINS GREENLEE BROS.

SCHRECONGOST

Richard K. Schrecongost has joined GREENLEE BROS. & CO. as consultant to the B & T MACHINERY CO., a subsidiary of Greenlee Bros. His headquarters will be in Rockford, Ill. Before coming to Greenlee Bros., Schrecongost was a consultant to the die casting machine industry.

ARWOOD EXPANDING

ARWOOD PRECISION CASTING CORP. is expanding or modernizing all four of its plants, which produce ferrous and non-ferrous investment castings. Rawson L. Wood, president, points out that for the first time since World War II, the trend of commercial bookings indicates they will overtake government bookings.

Here is the expansion program:

- The plant at Los Angeles already has increased its capacity by 60 percent, and a new building under construction will be completed this summer.
- The Groton, Conn., plant has been enlarged to permit a 50 percent increase in its capacity to handle large castings.
- The plant at Tilton, N. H., is expanding its present building to meet the increased demand for wave guide castings and to house new magnesium heat treating facilities.
- The Brooklyn plant has completed installation of a new X-ray unit, a carbon restoration heat treating unit, and additional tooling facilities.

REYNOLDS UPPING OUTPUT

REYNOLDS METALS CO. will boost its primary aluminum output to 93% of its annual rated capacity of 601,000 tons to meet market demands for pig and ingot. Reynolds is restarting one potline at its Listerhill, Ala., reduction plant and about three-fourths of a line at its Jones Mills, Ark., plant, adding 15,000 tons to the annual production rate at each plant. The move will reactivate lines which were shut down last September.

COOLBAUGH HEADS CLIMAX

COOLBAUGH

New president of the CLIMAX MOLYBDENUM CO., DIV. OF AMERICAN METAL CLIMAX, INC., is Frank Coolbaugh. Formerly a vice president and director, Coolbaugh succeeds Weston Thomas, who was elected executive vice president of the parent organization.

OLIN DISTRIBUTORS STOCK CASTING ALLOYS

Aluminum casting alloys are now available from stock at these distributors of OLIN MATHIESON CHEMICAL CORP., METALS DIV.: Alabama – L. A. Draper Metals, Inc., Anniston; California – McGowan Co., Inc., Los Angeles; Globoly Metals Inc., Oakland; Delaware – North American Smelting Co., Wilmington; Missouri – Atlaw Distributing Co., Kansas City; New York – Henning Brothers & Smith, Inc., Brooklyn; Ohio – Midwest Aluminum Supply Corp., Cleveland.

VANADIUM-ALLOYS PROMOTES HEBERT

Robert E. Hebert has been appointed manager of the new Vacuum Melting Dept. at VANADIUM-ALLOYS STEEL CO. Formerly a metallurgist, Hebert will supervise all operations of the consumable arc

. . . and these fine finish plumbing fixtures tell you why

Quality is fashioned by craftsmanship. Take these sparkling chrome plated zinc castings. Note their modern, graceful lines and soft, smooth finish . . . made possible only by the qualities of purity and surface soundness and uniformity of the alloy; and the rigid maintenance of close tolerances by controlled production methods and equipment.

And here is something else! The serrations for the mating spline in the handles of these fine fixtures are held to close dimensional tolerances by reason of the identical same qualities that govern the economical production of these castings.

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Tel: Edison 1-6888

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363 West First St.
Tel: Baldwin 4-3523

DETROIT, MICHIGAN
J. R. Lemen, Jr.
1016 Fisher Bldg.
Tel: Trinity 3-5910

NEW ENGLAND
R. L. Thomson
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Stamford, Conn.
Tel: Fireside 8-3985

PHILADELPHIA, PA.
Albert B. Reid
505 Wadsworth St.
Tel: Chestnut Hill 7-8833

Latrobe Die Casting Co.
Latrobe, Pennsylvania

Established 1918

For more information circle No. 29 on the Reader Service Card

vacuum melting furnace recently installed in the firm's plant in Latrobe, Pa. In another appointment, C. J. Stalnaker was named product metallurgist in the same department.

ENTHONE PROMOTES THREE

C. C. Helmle has been named vice president and general manager of ENTHONE, INC., a subsidiary of AMERICAN SMELTING AND REFINING CO. Formerly vice president and sales manager, Helmle will continue as sales manager in addition to his new duties. Edward B. Saubestre, formerly assistant to the research director, was appointed technical director. William K. Murray was promoted from manager of customer service to manager of marketing.

FORMS DIE CASTING PLANT

A new zinc alloy die casting plant — SOUTHERN DIE CASTING CO. — has been formed in Miami, Fla., by Alex L. Homery, president. Located at 13121 South Dixie Highway, the firm will specialize in zinc alloy castings up to 2 lb for a variety of industrial end uses. Plant operations include custom mold and die making, casting, wet and dry barrel finishing, plating, and complete testing and inspection.

HOLMES JOINS HOEGANAES

HOLMES

Ross Holmes has joined HOEGANAES SPONGE IRON CORP. as manager of the pre-mix department. He formerly was with Ford Motor Co., as section engineer of the development, process, and control laboratory of the Powdered Metal Operations.

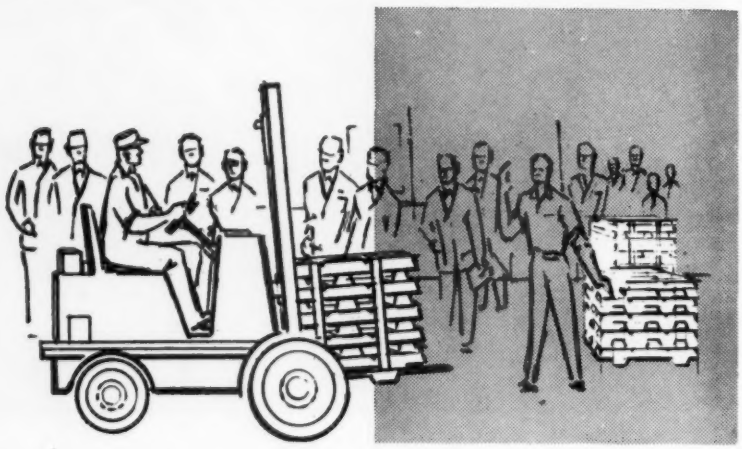
JOINS DME SALES STAFF

Wayne Smith has joined the sales staff of DETROIT MOLD ENGINEERING CO. Formerly a mold buyer and mold estimator at Erie Resistor Corp., Smith will represent DME in western New York, western Pennsylvania, and Ontario.

CHAPMAN JOINS HITCHINER

CHAPMAN

Edwin G. Chapman has been appointed sales manager at HITCHINER MANUFACTURING CO., INC. For the past eight years Chapman had filled a variety of sales, engineering, and manufacturing positions for Misco Precision Casting Co., most recently that of chief engineer.



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PMM TECHNICAL REFERENCE FILE

PROPERTIES OF EXTRUDED ALLOYS — TABLE XI

Fabricating Characteristics and Corrosion Resistance of Magnesium Extrusion Alloys

	Fabrication[1]						Corrosion Resistance[2] (bare metal)		Availability		
Alloy and Temper	Cold Forming	Hot Forming	Arc Welding	Resistance Spot and Seam Welding	Brazing	Machining	Rural Atmosphere	Marine Atmosphere	Extr. Solid Shapes	Ext. Hollow Shapes	
A3A	B	A	A	A	B	A	A	C	*	*	Nuclear applications. Has same low tendency to absorb neutrons and same rapid decay of induced radio-activity as pure magnesium but higher structural strength than primary magnesium.
AZ31B	B	A	A	A	B	A	A	C	*	*	General applications. AZ31B is the most widely used magnesium extrusion alloy. It possesses moderate strength and good formability as does AZ31C, a commercial grade material possessing the same properties and tolerances as AZ31B, but having higher impurity limits in its composition than AZ31B.
AZ31C	B	A	A	A	B	A	A	D	*	*	
AZ61A	B	A	B+	B+	C	A	A	C	*	*	Moderately high strength applications. AZ61A has improved strength over AZ31B.
AZ80A-F	B	A	C	C	C	A	A	C	*		High strength applications. AZ80A can be artificially aged for further improvement of its properties, but it exhibits less ductility than ZK60A-T5.
AZ80A-T5	C	B	C	C	C	A	A	C	*		
M1A	C+	B	B+	B+	B	A	B	D	*	*	General applications. Used where strength requirements are not severe. Unlike AZ31B, it needs no stress relief treatment after welding.
ZK21A	C	B	A	A	C	A	B	C	*	*	General applications. Has improved strength over M1A and does not need stress relief treatment after welding.
ZK60A-F	C	B	NR	NR	C	A	B	D	*	*	High strength applications. Has good toughness. ZK60A has better ductility than AZ80A-T5 and is available as hollow shapes. It may also be heat treated for further improvement of its properties.
ZK60A-T5	C	B	NR	NR	C	A	B	D	*	*	
ZK60B-B	C	B	NR	NR	C	A	B	D	*		High strength applications. Maximum properties in large shapes. Have highest compressive yield strength of all the magnesium alloys.
HM31A	C+	B	A	A	NR	A	B	C	*	*	Elevated temperature applications. Possesses good properties to temperatures as high as 900° F for short times and lower temperatures for long times.

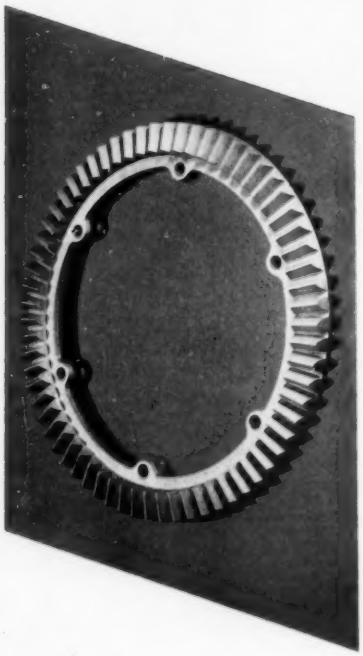
NOTES

[1] Relative fabrication ratings indicate: 'A' excellent, 'B' good, 'C' fair, 'NR' not recommended.

[2] Ratings in all columns are interrelated. An 'A' rating is highest. 'D' is lowest. These ratings are relative for magnesium alloys only and do not compare directly to ratings for other metals.
Rural atmosphere: Inland and uncontaminated by smoke and fumes from industrial processes.
Marine atmosphere: Frequent salt mist.

No machining needed on this . . .

Permanent Mold Casting



This large bevel gear needs no machining. As a sand casting the gear was unprofitable because of costly machining operations. The permanent mold casting process was selected because it produces a casting made to precise tolerances with a minimum of scrap.

We welcome your inquiries.

ECC Eastern Casting
CORP. DIVISION
THE EASTERN MALLEABLE IRON CO.
69 South Williams St.
NEWBURGH, N. Y.

Circle No. 19 on Reader Service Card

Impact-Extruded High Pressure Body

By P. G. SMITH*

NEED A CAN that will withstand 1000 psi oil pressure on the inside with only atmospheric pressure outside? That's what GPE Controls, Inc., needed for one of its oil filter bodies.

What's more, the filter had to be as light as possible, and that meant an aluminum body. A cast body would never do the job because too many were porous – mostly micro-porosity that couldn't be detected by X-ray examination.

A welded assembly made from plate and tubing might do the job, but many of the welds leaked and, besides, such an assembly was very expensive.

The actual solution was simple: An impact extrusion made by Bridgeport Brass Co. The aluminum is extruded to the final size and shape so that the only machining needed is to face the top surface and cut threads. The alloy 6011-T82 has plenty of strength and, of course, with a single extrusion, leakage is impossible.

Even the square, wrench boss on the base is a part of the extrusion.

Figure 1 shows the finished extrusion, ready for assembly after threads have been cut on the top to hold the cover. The dimensions of the extrusion are shown in Figure 2.

Some of the specifications for this impact extrusion are:

Surface finish
125 microinches RMS

Concentricity ID to OD within 0.010 TIR

Mechanical properties of alloy

Tensile strength	35,000 psi
Yield strength	32,000 psi
Elongation in 2"	3%

*GPE CONTROLS, INC.

FIGURE 1.

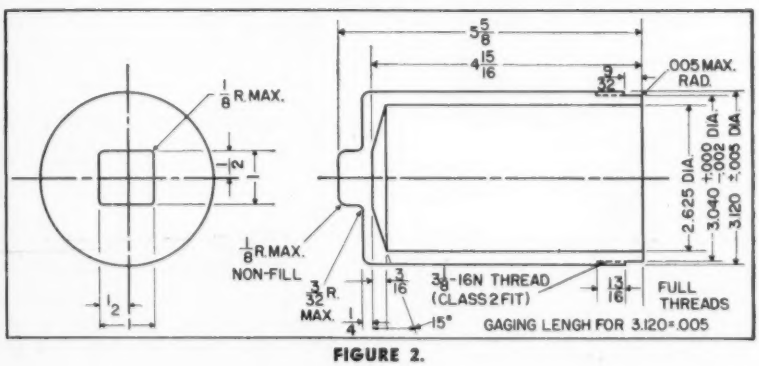


FIGURE 2.

NEW PRODUCTS

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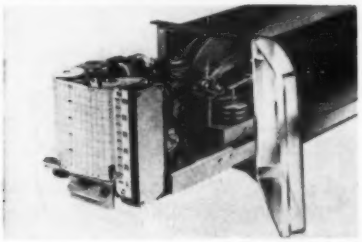
POTENTIOMETERS



THE BRISTOL CO. — The Dynamaster 663 series of potentiometers, pyrometers, a-c and d-c bridges, and differential transformer receivers, are now available in pneumatic transmitting models. They transmit a 3-15 psig signal continuously. The series is easily adapted to ratio, cascade, and computer-type control systems.

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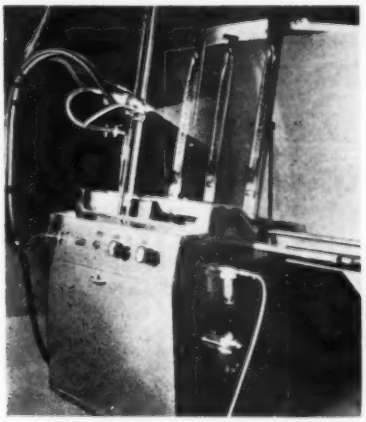
SPRAY PAINTING MACHINES



DUMATIC DEVICES INC. — An automatic spray painting machine that can be tied in with a conveyor line. The spray guns pick up the part as it moves along the conveyor and follow it. The painting completed, the assembly disengages and returns to pick up the next part.

Circle No. 251 on Reader Service Card

FLOW REGULATING DEVICE

HAYS MFG. CO. — Regulates hot or cold water automatically. It permits a specified rate of flow regardless of inlet pressures. Available in 49 flow rates from 2 G.P.M. to 50 G.P.M., the unit can be used on die casting machine water lines.

Circle No. 253 on Reader Service Card

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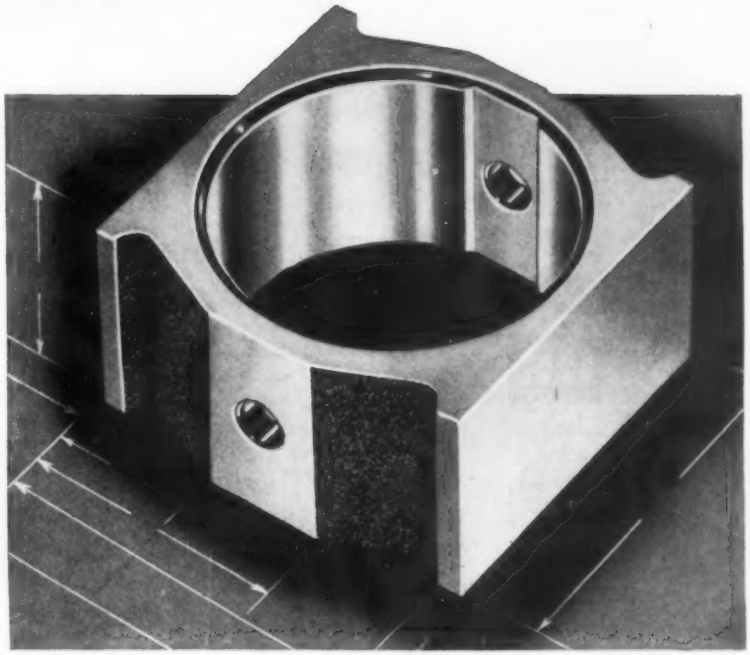
many difficult requirements...



We illustrate the cast bronze cam block for a hydraulic pump operating the hydraulic lift mechanism on an exceedingly well-known line of farm tractors.

The manufacturer of this equipment has very unusual specifications for this cam block. Its bore has a very fine finish specification. It also must be round and true to size within unusually close limits. In addition, it must be square to the face of the cam block within limits that ordinary methods of manufacture will not attain.

Bunting methods of manufacture result in a part which is completely to the customer's exacting specifications.

For the unusual, as well as the usual, in bearings, bushings, bars, or special parts of cast bronze, sintered metal, or Alcoa aluminum, see Bunting first.

BUNTING SALES ENGINEERS in the field and a fully staffed Product Engineering Department are at your command without cost or obligation for research or aiding in specification of bearings or parts made of cast bronze or sintered metals for special or unusual applications.

...ask or write for your copy of...

Bunting's "Engineering Handbook on Powder Metallurgy" and Catalog No. 58 listing 2227 sizes of completely finished cast bronze and sintered oil-filled bronze bearings available from stock.

Bunting®

The Bunting Brass and Bronze Company
Toledo 1, Ohio—EVergreen 2-3451
Branches in Principal Cities

BEARINGS, BUSHINGS, BARS AND SPECIAL PARTS OF CAST BRONZE OR SINTERED METALS. ALCOA® ALUMINUM BARS

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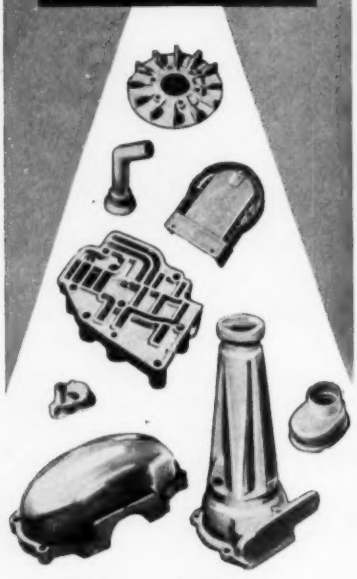
Paramount

YOUR BEST SOURCE



Flexibility

. . . a by-word with PARAMOUNT

Large castings, small castings, varied shapes and sizes . . . thin walls, combining strength and rigidity . . . close tolerances that eliminate machining — are every day routine at PARAMOUNT.

Our designers, sales engineers, plus modern tooling and production facilities are available for your complete die casting requirements.

WRITE FOR FREE DESCRIPTIVE BROCHURE

ALUMINUM ZINC MAGNESIUM

Paramount DIE CASTING COMPANY

St. Joseph 22, Michigan

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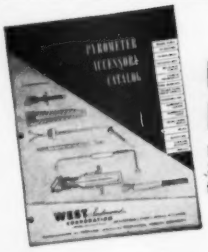
For more information circle No. 51 on the Reader Service Card

THERMOCOUPLES
for every industry



DATA BOOK

New 32-page file book

★ Handily lists all data (I.S.A.) and

★ Graphically shows easiest way to select precisely the best thermocouple and protective tube for each operation.

★ Lists all components, with prices and

★ Provides handy reference for stock record.

STANDARD AND SPECIAL

For furnaces, ovens, kilns, moulding machines, pipelines, freezers, etc.

For use with all standard types of temperature indicators, controllers, recorders.

We make thermocouples from matched and checked wires to insure constant millivolt output for accurate readings. Complete selection.

FREE *write for your copy Now . . .*

WEST Instrument CORPORATION

CHICAGO

SALES OFFICES IN PRINCIPAL CITIES

Attention Die-Builders!

SLASH NEW DIE-CURING TIME FROM 3-WEEKS TO 3-HOURS!

NOW! Dylube #710 offers the die-caster "run-in" UNIFORMLY conditioned new die cavities. Dylube #710 provides a new coating process that's been job-proven by leading die-builders and die-casters. Conditions a green die for immediate trouble-free production; prevents undercuts; erosion; pitting; stickers and drag. Facilitates metal flow, overcomes many gating deficiencies and solder.

WRITE FOR FREE SAMPLE And Information On Dylube #710

AMERICAN CHARCOAL CO.

201 SOUTH GREEN STREET DETROIT 17, MICHIGAN

For more information circle No. 5 on the Reader Service Card

NEW PRODUCTS

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PATTERN MATERIAL

The J. I. HOLCOMB MFG. CO., has developed a synthetic wax-like pattern material for investment casting. The material is controlled for quality and physical characteristics. It features high strength, ability to fill out smallest radii completely, dimensional stability.

Circle No. 242 on Reader Service Card

CLEANING AGENT

Teclene, a solvent-detergent emulsifier, has been developed by

continued on next page

For more information circle No. 43 on the Reader Service Card

Remet Powdered Metal Part
cuts
DESIGN
and
MACHINING
costs
for Bonney Forge and Tool Works

R. L. Huston, Chief Engineer for Bonney, says, "We went to a powdered metal part on our shifter because the cost of machining this part from steel would have been prohibitive. Also, we would have had to change the entire design of our ratchet. We contacted no less than a dozen fabricators of powdered metal. Reese Metal Products Corp. was the only establishment able or interested in tackling this problem with us."

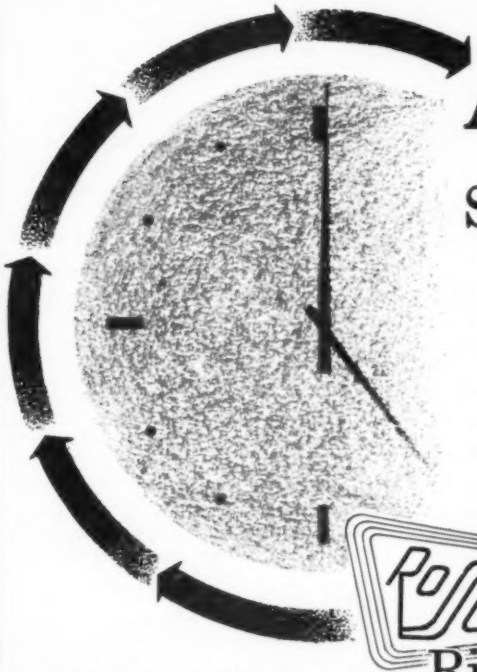
Bonney now uses Remet shifters in seven of their ratchets. The sintered Remet parts are copper infiltrated iron.

More and more design and production men each year rely on Remet services to help solve problems.

FREE BROCHURE "How to Cut Precision Parts Cost with the Remet Powdered Metal Process" shows how the Reese Corp. can help you. Send for your copy today.

Remet
REESE METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets
"Oilless" Bearings • Bushings • Machine and Structural Parts in
COPPER • BRASS • IRON • ALLOY
STEEL • NICKEL SILVER • COPPER
INFILTRATED IRON



Around the Clock

Service and Production

When your production department is yelling at you to get those castings out "yesterday", you'll get the fastest service on your dies by coming to R. O. Schulz. We're set up for speed. We have the machines to make your dies, whether they're 15 tons or a few pounds, and the skilled designers and die makers to make them right. You get top quality workmanship at lowest cost when you take advantage of our specialized die and mold making facilities.

ELMWOOD PARK, ILLINOIS

Richard O. Schulz Company

DIE CASTING DIES • PLASTIC INJECTION AND COMPRESSION DIES

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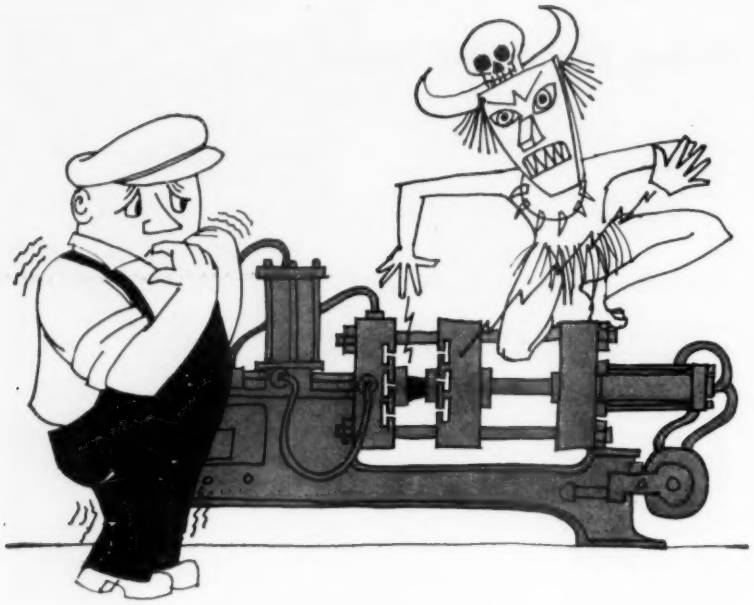


Don't bewitch stuck castings...use Die Slick!

Prevent stuck die castings, as well as scoring and soldering—*ahead* of time with Die Slick. Compounded under laboratory quality control, there is a grade of Die Slick for *every* job, no matter what metal or alloy you are casting, no matter what your production rate, and no matter how you apply the compound.

For aluminum die casting we recommend new Die Slick No. 44, the thixotropic compound that thins with solvent, kerosene, *or* water. It gives quick, clean casting release and when thinned with water reduces fire hazard, storage space and overall cost.

For zinc die casting we recommend Die Slick No. 9X, the stable emulsion that thins way out as far as 10 to 1 with water. 9X won't clog spray guns.

Order a gallon today, specifying the metal or alloy you are casting. Pay the invoice only if you are satisfied.

Die Slick is a registered trade mark of G. W. Smith & Sons, Inc.

DIE SLICK

used by die casters everywhere

G. W. SMITH & SONS, INC.,

1703 SPAULDING ROAD, DAYTON 32, OHIO

For more information circle No. 45 on the Reader Service Card

NEW PRODUCTS

continued from page 63

TECT, INC. The cleaner has no flash point and may be sprayed or brushed on a surface. Although alkaline, it can be used in the cleaning of all metals.

Circle No. 243 on Reader Service Card

COATING THICKNESS TESTER

Dermitron Model D-2 is a portable non-destructive coating thickness tester, available from UNIT PROCESS ASSEMBLIES, INC., that gives fast, accurate and direct readings of virtually any coating on any base including: metal coatings on metal base; non-metallic coatings on metal base; and metal films on non-metallic base.

Circle No. 245 on Reader Service Card

PMM OPPORTUNITIES

jobs & equipment

Opportunities rates: $20 for the first olumn-inch; $15 for each aditional column-inch payable in advance. To answer box number advertisements, address responses to the box at Precision Metal Molding, 812 Huron Rd., Cleveland 15, Ohio. Closing date: 1st day of month preceding publication.

POSITIONS OPEN

Diamond saw manufacturer requires metallurgist of proven ability, technical knowledge and "know how" of manufacture and application of: diamond impregnated powder metal parts for sawing, drilling, grinding. Position can lead to top level management. Application with details to Box 7459.

PROGRESSIVE, EXPANDING MANUFACTURER SEEKS A MAN EXPERIENCED IN DIE CASTING, ENGINEERING, PRODUCTION

for
- Analysis of die cast products vs. stampings
- Production supervision of new die cast department
- Advisory function in construction of die cast tools

Reply: Personnel Director, Atwood Vacuum Machine Company, 1400 Eddy Avenue, Rockford, Illinois.

POWDERED METAL
PRODUCTION FOREMAN

The man we are looking for must have a background of practical experience and a record of accomplishment in multi-shift powdered metal fabrication. He must be able to take complete charge of production for a high-volume operation located in Southern California. Should be familiar with tooling and have a working knowledge of powdered metallurgy. Top wages for qualified man. Retirement and other benefits are among the best in the area. If your qualifications meet our requirements, send complete resume to

Box No. 7349, Precision Metal Molding.

CHIEF ESTIMATOR
for
DIE CASTING PLANT

Medium size, long established, modern, progressive company. Send complete resume to the Stroh Die Casting Co., Inc. 11123 W. Burleigh Street, Milwaukee 10, Wisconsin.

NORTH CAROLINA multishift concern requires experienced aluminum die casting superintendent, capable of assuming complete supervision of production, costs, quality and scheduling. State salary in resume to

Box No. 7159, Precision Metal Molding.

DIEMAKERS

Are you experienced in making Die Cast Dies and Permanent Molds for Aluminum Castings? Qualified Journeymen desiring exceptional opportunities for advancement in this rapidly expanding new industry send resume to:

CHEVROLET ALUMINUM FOUNDRY
Division of General Motors Corporation
Massena, New York

REPRESENTATIVES WANTED

JOBBERS WANTED

We manufacture Kob-Kleen (ground corn cobs) for deburring, burnishing, polishing and soft grit blasting of metals; metal stamping absorbents, etc. Nationally advertised. COEVAL, INC., Dept. J, St. Joseph, Illinois.

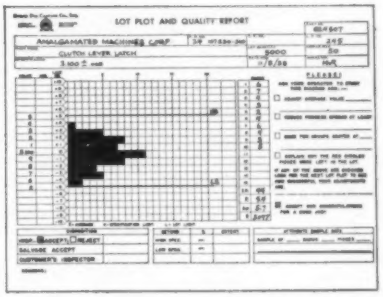
EQUIPMENT FOR SALE

ABRASIVE BELT GRINDERS

Ideal for investment castings 2" x 60" Porter Cable Model CN2 ½ HP 220 volt 3 phase. Like new. $70.00 each lots of 2 or more. Box 7259.

STROH INTRODUCES
STATISTICAL QUALITY CONTROL FOR DIE CASTINGS

DIMENSIONAL CONTROL AT STROH DIE CASTING BEGINS WITH A CHART LIKE THIS . . .



Here's what the new concept of Quality Control at Stroh Die Casting means to you

CRITICAL DIMENSIONS can be held within specified limits. Buyers who rely on statistical dimensioning to assure accurate parts for assembly are invited to consult Stroh.

LOWER INSPECTION COSTS come from simpler receiving inspection instead of full sampling of each shipment of die castings. Many manufacturers now benefit from Stroh's Quality Control.

Write for Details

IN OUR 56th YEAR

Stroh Die Casting Co., Inc.

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THOUSANDS OF EXTRA POURS PER LADLE

with

SPINCRAFT LADLES

Light, rugged, Spincraft ladles save replacement costs, make every pouring job easier! Available in a vast range of sizes, in stainless steel as well as mild.

- LIGHT IN WEIGHT LESS FATIGUE!
- NON-SPILL SHAPE NO WASTE!
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SKILL WILL DO IT
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Circle No. 21 on the Reader Service Card

Improve surface finish, increase die life and control casting solidification with

Foseco DYCOTE

coatings for permanent molding and die casting components

This bulletin tells you how. Send for your free copy today.

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FOUNDRY SERVICES, INC.

P. O. Box 8728, Cleveland 35, Ohio

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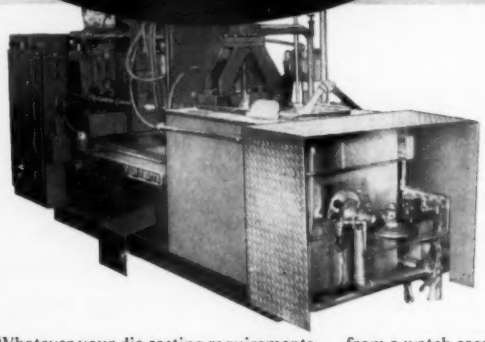
NOW!

IMPORTANT NEWS

to users of Small Castings

HAMPDEN BRASS ADDS NEW HIGH SPEED, FULLY AUTOMATIC ZINC DIE CASTING MACHINE

With the purchase of this new Zinc Machine, the capacity of our Zinc Section has been increased considerably. This is in keeping with our constant efforts to improve our facilities, thereby permitting us to serve our customers even better.



Whatever your die casting requirements . . . from a watch case to a car door, Hampden Brass is prepared to meet your specific needs . . . quickly, efficiently and to exacting specifications. Our sales engineers are always ready and prepared to assist you in any way possible.

2 New 1000 Ton Die Casting Machines Added Recently

A short time ago, we purchased 2 die casting machines of 1000 ton capacity . . . in addition to our 400 and 500 ton die casting machines. These machines, together with our new Zinc Machine, allow us to fulfill your aluminum and zinc die casting requirements . . . from the smallest to the largest size.

Send for brochure, "Behind the Scenes" . . . complete digest of Hampden Brass's experience, equipment and facilities.

For Guaranteed Quality Look to the Diamond of the Industry

Established 1903

HB

HAMPDEN BRASS & ALUMINUM CO.

SPRINGFIELD 1, MASS.

Non-Ferrous Castings: *Sand, Permanent Mold, Die and Structural Fiberglas*

Complete Pattern & X-ray Lab Facilities

For more information circle No. 23 on the Reader Service Card

DATA OFFERED IN THIS MONTH'S ADS

the Reader Service Cards facing the last page will get you these free reference materials. Circle the numbers and mail.

1. **Lubrication** — Technical data on graphite-water base dispersions for forging lubrication is available from Acheson Colloids Co.

3. **Sinterings** — Engineering Bulletin 3020 from American Sinteel Corp. gives technical data on ferrous and non-ferrous powdered metal products and their design.

5. **Die-Curing** — time is said to be greatly reduced with the use of Dylube #710. Technical data is available from American Charcoal Co.

9. **Investment Casting** — "Practical Guide to Investment Casting," is a 44-page design handbook from Arwood Precision Casting Corp.

12. **Sintering** — The "Engineering Handbook of Powder Metallurgy," and Catalog No. 58, which lists 2,227 sizes of completely finished cast bronze and sintered oil-filled bearings, are available from Bunting Brass & Bronze Co.

14. **Die Casting** — machines for every die casting need are listed in a specification catalog from Cast-Master.

17. **Die Castings** — Brochure from DiSalle Plating & Die Casting Co., presents a picture story on their facilities for making your specialized die casting.

18. **Standardized Die Components** — which reduce design time and cut die construction costs, are described in a 170-page catalog. The Detroit Mold Engineering Co.

20. **Eliminate Oxides** — dirt and other impurities from aluminum and zinc melts with Foseco Coverals. Technical bulletin from Foundry Services, Inc.

21. **Improves Surface** — finish, increases die life and controls casting solidification. Technical bulletin on Foseco Dycote for permanent molding and die casting components. Foundry Services, Inc.

22. **Small Die Castings** — Technical data on "Small Zinc Alloy Die Castings." Gries Reproducer Corp.

23. **Die Casting** — "Behind the Scenes" is a report from Hampden Brass & Aluminum Co. on their facilities for handling your aluminum and zinc die casting requirements.

GRC tiny die castings

made in one fast automatic operation ...simple or intricate parts, high in quality, low in cost

Gries' exclusive patented methods make possible wide design latitude . . . assure uniformity, accuracy and smooth surfaces on small parts of all types . . . for a wide variety of uses . . . at substantial savings. GRC die castings leave the machines trimmed, ready-for-use. In addition GRC's unique single cavity die casting techniques offer new short-cuts in assembly . . . new approaches in product design through our exclusive . . .

tiny zinc die castings

NO SIZE TOO SMALL! Maximum sizes up to 1¾", ½ oz.

Write for fact-filled booklet "Small Zinc Alloy Die Castings," includes helpful designer's check list.

GRIES

GRIES REPRODUCER CORP.

World's Foremost Producer of Small Die Castings

157 Beechwood Ave., New Rochelle, N. Y. NEw Rochelle 3-8600

For more information circle No. 22 on the Reader Service Card

THE PIERCE-WALLER

AIR-LUBE SYSTEM

CUTS COSTS for DIE-CASTERS

- CLEANS
- LUBRICATES

Remove loose flash and clean the mold with a powerful, clean air blast — then lubricate all mold surfaces evenly, *using the same gun* —with a flick of the thumb! Adjustment *at the gun* for full range from zero to a heavy mist, spraying, fogging, or vaporizing the lubricant. Speeds up mold operation and reduces casting rejects. Makes every machine cycle count.

USED IN LARGE AND SMALL SHOPS EVERYWHERE!

WRITE FOR *FREE* FOLDER

PIERCE-WALLER, INC.

P.O. Box 2121A • DAYTON 29, OHIO

***Plant:* RAJAK MFG. CO.**

Specialists in polyester impregnation of metals

245 N. Fourth St. • Tipp City, Ohio

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24. Zinc Alloy Facts — "Reference Book and Guide on Zamak Die Casting Alloys." Includes production and design data. Henning Bros. & Smith, Inc.

28. Compacting Presses — Engineering data from Kux Machinery Co. on presses that feature push button control, positive mechanical pressure stop mechanism, etc.

31. Die Castings — Design data from Litemetal Dicast, Inc. on aluminum, magnesium, and zinc die castings.

33. Fluxes — Improved fluxes for zinc, and aluminum are described in technical literature from Milles Equipment & Supply Co.

39. Die Castings — Brochure from Paramount Die Casting Co. describes their facilities for producing your specialized casting.

41. Cleans, Lubricates — That's what the Air-Lube System, manufactured by Pierce-Waller, Inc. does. Technical data sheets are available.

43. Sintering Savings — Technical report, "How to cut Costs With The Remet Powdered Metal Process," is available from Reese Metal Products Corp.

46. Ladles & Skimmers — Technical data and prices are available from Spincraft, Inc. on their stainless steel ladles and skimmers.

47. Statistical Quality Control — for die castings. Technical literature, from Stroh Die Casting Co., Inc., describes the use of quality control for lower inspection costs.

48. Fire Prevention Data — "Ucon Hydrolubes Spell Safety" is a technical report on fire-resistant fluids. Union Carbide Chemical Co.

51. Thermocouples — 32-page data book graphically shows how to pick the right thermocouple for each operation. West Instrument Corp.

52. Ultrasonic Cleaners — Engineering data on cleaners built for performance and durability. Acoustica Associates, Inc.

53. Finishing Data File — on process chemicals for the metal finishing industry. Allied Research Products, Inc.

54. Spindle Finishing — Engineering data on the spindle finishing process for precision finishing of complete components. Almco, Queen Products Div.

55. Barrel Finishing — Technical data on how to get the most out of barrel finishing. Oakite Products, Inc.

68. Die Casting Lubricants — Technical literature on lubricants for all die casting purposes. The Die Casting "ID" Corp.

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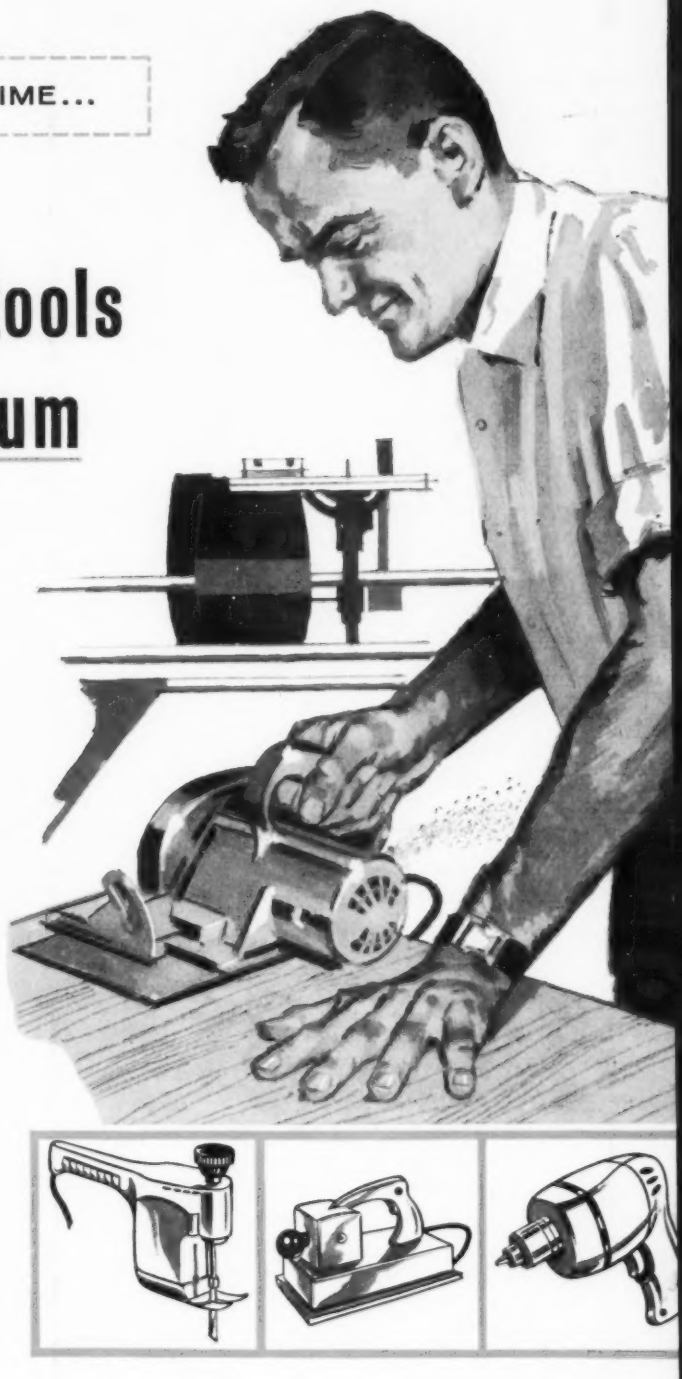

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